RAILROAD GAZETTE

FRIDAY, JUNE 17.

CONTENTS.

Contributions.

Cost of Freight Car Repairs.

June 11, 1892.

TO THE EDITOR OF THE RAILROAD GAZETTE:

For the information of "An Old Railroader" [see *Gazette* of June 10], I would say that the cost of repairs to freight cars, as stated in my article in the *Railroad Gazette* of June 3, is on a basis of train mileage, and not cost per car mileage. SYNTAX.

Why Not Make Staybolts Larger?

PITTSBURGH, May 25, 1892.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In almost every other detail of locomotives and machinery it is customary to make a part larger or of better material whenever it breaks in service. Whenever failures are common with any device it is customary to make it stronger. Why should not this rule apply to staybolts in locomotive fireboxes? This question I would like to ask the readers of the *Railroad Gazette*, and to illustrate what is meant I send some drawings showing staybolts as formerly used and as they might be used.

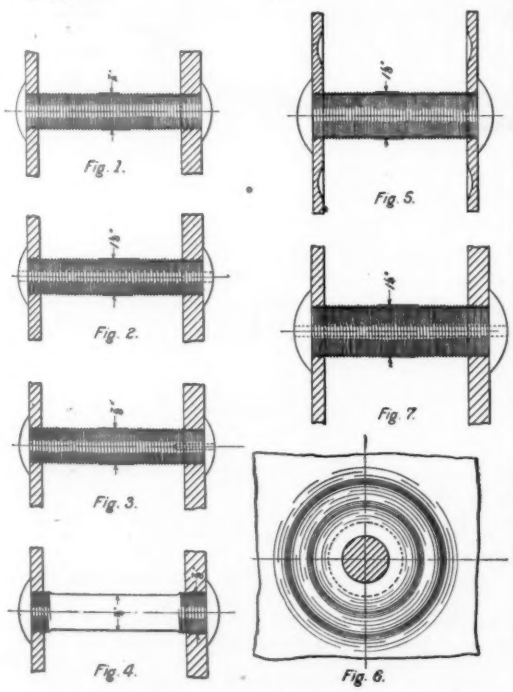


Fig. 1 shows the ⅞ staybolt most commonly used. Fig. 2 a hollow staybolt 1⅛ in. in diameter. Fig. 3 the ⅞ staybolt drilled with the tell-tale hole on the outer end. The fire end in all these illustrations being on the left hand side of the cut next to the thin sheet. Fig. 4 shows the ⅞ staybolt reduced between the sheets.

These are the forms of staybolts now generally used, a large majority being as shown in fig. 1. After a very little service these stay bolts crack next to the thicker or outer sheet. Some crack sooner than others, depending upon several conditions. Those conditions which affect the cracking are about as follows: (a) The sharpness of the cutting die for the thread. (b) The length of staybolt. (c) The expansion in the firebox. (d) The quality of material of which the bolt is made. (e) The character of the service to which the engine is put; that is, whether the boiler is forced or not. (f) The tightness of the fit of the staybolt in the outer sheet.

Probably the inspection and repairs of broken staybolts are, outside of the repairs to tubes when the feed water is bad, the most expensive and annoying of all the repairs to locomotive boilers; yet those in charge of locomotives and those who build locomotives seem to accept the breakage of staybolts as unavoidable, and go on from day to day paying the bills for repairs without stopping to ask the question, "Cannot these breakages be reduced?" So accustomed have railroad men become to broken staybolts that outside of a careful selection of the material used for repairs, little or nothing is done to search for some means of reducing the breakages. One can hardly say that any considerable attention is paid to the staybolt material used for new boilers. Most all railroad men have a favorite brand of staybolt iron, yet they are continually buying engines with staybolts made of a good high grade iron of no particular brand, and not subject to test.

Curiously enough, builders of one class buy the softest iron they can get for staybolts, while another class buys a hard and stiff iron. One argues that soft iron will bend more without breaking; the other maintains that the hard iron is more elastic, and will bend more without exceeding the elastic limit. From this it will be seen that both assume that staybolts are roughly used, and the iron is badly placed to withstand a strain; yet, as I have before said, no one is making an investigation to determine if a material does not exist that can be used for staybolts, and of a sufficient size to reduce enormously the breakages now common.

One builder will use a sharp die, and another a rounded one, to cut the threads of staybolts. In some cases the bolts are made a tight fit in the sheet, and in another they are fitted loosely. It is not known for a fact, but it is probable that those staybolts last longest that are cut with a rounded sharp die and are fitted loosely to the sheets, as the joint between the bolt and the sheet is then less rigid and there is less danger of a crack starting.

Some years ago when it was customary to use screw staybolts in marine boilers and before the pressures were as high as now, fig. 5 represented the condition of a sheet in an old boiler which had been stayed by screw stays. The staybolts were sometimes made 1⅛ in. in diameter and were placed from 6 to 8 in. between centres. The sheets being comparatively thin and more flexible than the staybolts, the expansion caused generally a buckling of the sheet instead of a breaking of the bolt. Of course, the bolts did break, but not with the same frequency as at present, the sheets being now thicker, and the staybolts smaller and shorter. The buckling of the sheets caused the scale or oxide to be cracked off and the water attacked the freshly exposed metal, which was again oxidized and finally there was a groove formed all around the staybolt; as shown in figs. 5 and 6.

In some cases the groove was so deep that only $\frac{1}{16}$ of an inch of metal remained. In other cases the sheets broke through at the bottom of the groove.

At present the sheets are thicker, the staybolts shorter, and the pressures higher for locomotive work. The result is that the sheet is stiffer than the bolt, and naturally instead of the sheet buckling as much as formerly the staybolts crack next to the thick sheet. Now the question I want to ask is whether we should not use 1¼, 1⅜ or 1½ inch staybolts, thus making them somewhere near as stiff as the sheet? Perhaps then we might get some grooving, but would we not at the same time get less broken staybolts? STAYS.

Quick Action Brakes.

CHICAGO, June 11, 1892.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I desire to call your attention to a very peculiar argument of Mr. Massey, in his communication published in your issue of the 10th inst. He points out the fact that the New York brake, while it does not get the full application as quickly as the Westinghouse, gets two pounds higher in the cylinder, and therefore stops the train just as quickly. You will doubtless see at once that this is all wrong, for the reason that either he does not get the two pounds higher braking force ultimately, or else, if he does, in order to come to the M. C. B.'s requirement of 70 per cent. maximum braking force, he must cut down his leverage so that he cannot exceed, in braking force upon a car, that which is the standard. EL.

American Society of Civil Engineers.

Last week we gave the programme of the Convention of the American Society of Civil Engineers, which was held at the Hygeia Hotel, Old Point Comfort, Va. The convention began Wednesday morning, June 8, and ended last Monday; and the programme printed last week was essentially followed out. The attendance was not so large as in other recent conventions, but, nevertheless, the members and their guests found the convention an eminently successful one.

Wednesday morning a paper was read by Mr. Foster Crowell on uniform practice in pile driving. A very brief abstract of this paper was given in our issue of June 3, and we shall not print a more extended abstract until we can give something of the discussion also, which contributed very decidedly to the value of the paper. Mr. Crowell examined and analyzed certain of the best known formulæ for the sustaining power of piles, showing the very great difference in their theoretical results. He then suggested a working formula. The discussion of this paper was fuller and more varied than that of any other paper presented, seven different members taking part in it. We may say in brief that the consensus of opinion brought out in discussion is that no formula can be much more than a more or less reliable starting point, and that the engineer must be governed to an unusual degree by the special conditions found in the case in hand. Various well known cases were cited in which piles were actually not driven by blows, but were sunk by the steady application of a weight, and have continued ever since to carry heavy structures and moving trains with perfect satisfaction. We hope to be able to reprint a considerable part of this valuable paper and of the discussion in an early issue.

In the afternoon a paper was read by Mr. John B. Duncklee on the Iron Wharf at Fort Monroe, Va. A short abstract of this paper follows:

This wharf was built by the United States Government in 1888–9 and is located at the terminus of the road fronting the Hygeia Hotel. It is built on hollow cylindrical cast iron disc and screw piles, spaced 14 ft. apart c. to c. in each direction. There are two systems of horizontal bracing, of steel and wrought iron. The floor beams are steel I-beams, and the joist and planking are of Georgia pine. The area covered is about 63,500 sq. ft. The extreme length is 332 ft. The disc piles are used from the shore out to 10 ft. depth of water. Outside of that are the screw piles. The discs were 3 ft. in diameter and 1½ ins. thick and the piles were sunk to about 6 ft. in the sand by the use of a 2 in. water jet. The floor beams were secured to cast flanges at the top.

The screw piles were each set over a creosoted wood-bearing pile; this being driven by a 2,200 lb. hammer, falling 15 ft. to a penetration of 1 in. at last blow. They were then cut off at about 4 ft. above the sand, and the iron piles screwed down over them until they were covered at least 3 ft. by the iron pile, the latter being then filled with concrete. Details of the fenders, bulkheads, etc., are given, as also the contract prices and amounts of each kind of material used. The piles are 12 in. in diameter, ½ in. thick, built with flush joints in sections 14 to 20 ft. long. There was a cast iron disc 4 ft. in diameter at the base of each. The transverse sub bracing consists of two lines of 12 inch channels 12 ft. apart vertically, and stiffened by angle bracing to make a rigid frame. The total length of the piles was 45 to 57 feet, and the pressure of water used in the jet for sinking was 30 to 60 pounds per sq. in. This would cause a penetration of about 6 feet, when an additional force of 85 tons was applied by block and tackle. This would sink the pile through the marl. Under subsequent loading of 64 tons per pile a settlement of ¾ inch to 6 ft. were obtained. The settlement would cease in about four hours, and after another four hours the weight was removed, the piles cut off and filled with concrete. The average weight of the piles is 4,800 lbs., and the total weight of the sub-structure 73,000 lbs.

This paper was also discussed at some length, much of the discussion being more applicable to the paper of the morning.

Mr. Desmond FitzGerald read a scholarly and valuable paper on "Rainfall, Flow of Streams and Storage," which was but briefly discussed. The paper presents 15 tables prepared during the summer of 1891, for the purpose of calculating the yield of drainage areas with varying proportions of land and water surfaces. The first table is a compilation showing the rainfall in the vicinity of Boston, month by month, for 74 years. Another table shows the rainfall in the Sudbury River watershed for 16 years. Other tables show the yield of this watershed for 16 years, the percentage of rainfall collected, and the evaporation from the water surface, the calculated yield per square mile, and the average yield of three watersheds per square mile compared.

After the adjournment of the afternoon session there was a parade and review of the garrison at Fort Monroe, given especially out of compliment to the Society. As the garrison is a pretty large one, five batteries being stationed there, the parade was more imposing than one often gets a chance to see in military posts in these times of peace. The President of the Society and Past-Presidents Greene, Francis and Worthen, the Commandant of the post and several other distinguished persons passed down the line, when it was paraded, and then took their positions at the reviewing point and the garrison marched past in review order. Some of those who watched the ceremony could not help wishing that the young officers could know a little of the story of the life of Past-President Greene, who, although in his 93d year, was one of the most active of those present. He is either the oldest or next to the oldest living graduate of West Point, and his long life has been full of distinguished service to the country, both in peace and war; and those who were familiar with the facts could not help feeling that his presence ought to be a stimulus to the young soldiers who saw him.

Wednesday evening President Cohen delivered the annual address. He chose as his subject the early history of the Baltimore & Ohio Railroad, and the paper is an interesting and valuable monograph, in which the results of much personal knowledge and of much research are gathered in a concise form, and presented with much literary skill. The dryness of a historical essay was relieved by the admirable way in which the personal element was introduced. The address gave

many suggestions of the very human rivalries and jealousies and ambitions which seem to have troubled the fathers of American railroading, much as they trouble their sons and grandsons to-day.

On Thursday the party visited the Norfolk Navy Yard and then went by special train to Virginia Beach, 18 miles from Norfolk. This is a pleasure resort which consists of absolutely nothing but the hotel. The railroad is a narrow gauge, crossing flat, uninteresting and almost uncultivated country. The Princess Anne Hotel is a thoroughly modern and very attractive structure, standing on the beach, looking out on the open ocean. Outside of the hotel and the ocean, however, there is absolutely nothing, and one cannot help being a little skeptical as to the commercial results of the whole enterprise.

Friday morning a business meeting of the Society was held. A resolution was passed tendering the congratulations and good will of the Society to Past-President Gen. George S. Greene, expressing pleasure in his presence, and directing a written copy of the resolution to be sent to him.

Colonel Craighill, as Chairman of the Committee of Arrangements, announced that the Chesapeake & Ohio Railroad Co. had offered free passes to Charleston, W. Va., and return, to enable members of the Convention to inspect the improvments of the Kanawha River.

The subject of the International Engineering Congress to be held during the World's Fair at Chicago, and of the Engineering Headquarters to be used there was brought up. Capt. R. W. Hunt explained at some length the present status and the necessity for knowing very soon how much the Executive Committee can expect in the way of money contribution from the American Society of C. E. The amount allotted to the Society is $3,000, of which $1,634 had been subscribed at the time of this meeting.

A report was received from the Board of Direction suspending the recent circular of the Publication Committee which restricted the advance publication of papers and discussions. The matter is now left as it has been heretofore, with the possibility of some further action by the Board of Direction. There was a little discussion on this subject, but the prevailing sentiment of the speakers was in favor of a very liberal policy in this matter.

The Nominating Committee was elected as follows:

First district, Alphonse Fteley.
Second district, P. C. Ricketts.
Third district, J. R. Freeman.
Fourth district, T. H. Johnson.
Fifth district, G. B. Nicholson.
Sixth district, James Dun.
Seventh district, J. B. Atkinson.

No other matters of especial importance were brought up at this meeting.

Friday afternoon several papers on steel were read; one on Hardening Structural Steel, by A. C. Cunningham; Results Obtained from Tests of Full Sized Steel Eye Bars, by Frederick H. Lewis, and Experiments on Iron and Steel Joints Riveted on an Angle, by Bertram B. Flint. The discussion of these papers was confined entirely to some remarks by Mr. William Metcalf, and those who know Mr. Metcalf's thorough knowledge of the manufacture of steel and of its properties, his admirable skill in presenting his opinions, his command of fluent and simple language, and his sense of humor, will believe that his talk was an intellectual treat. It was impossible, however, to take such notes as would give any fair notion of what he said, and it is hoped that his remarks will soon be published in full in the *Transactions*.

Mr. J. G. Dagron read a short but important paper describing the method of protecting the iron roof of a railroad tunnel in Philadelphia against corrosion. A supplementary roof of hollow tiles was put in, and the joints were carefully pointed with cement mortar from above. The roof was then cemented below also. There is an incidental advantage in the tunnel freeing itself more quickly from smoke and gases since the smooth continuous roof has been put in.

After the adjournment of this meeting many of the members and their guests went to the Fort to see some firing from heavy guns. The season for the regular practice firing had not begun, but the Colonel in command ordered this exhibition for the entertainment of the Convention. The firing was from a 15-in., smoothbore Rodman and from an 8-in., converted rifle. The targets were buoys placed at distances of 3,000, 2,700 and 1,700 yards, and everybody who saw the firing thought that the practice was very good. There were certainly some picturesque elements about it that appealed very strongly to some of the older members of the society. The Rodman gun which was fired, and many of its kind which are mounted on the parapets of the Fort, were cast during the war at the Fort Pitt foundry, Pittsburgh, under the direction of Mr. Metcalf, and as the reader knows, they were at that time the best guns in the world, although they are now thoroughly antiquated. The men present who saw something of the war could not help looking at them almost affectionately, realizing as they do the immense service which these guns rendered to the Union cause. The afternoon was windy, the sky was overcast, the water was pretty rough, and as the great shot went howling over the waves, many of the men who watched them and heard them were stirred to their toes by recollections of almost 30 years ago.

Friday evening Mr. Fteley gave an account of the new aqueduct in New York illustrated by over 100 lantern slides.

Saturday morning a large party of the members went to the shipyards of the Newport News Dry Dock & Ship Building Co. The Steamer El Norte was to have been launched, but unfortunately could not be got ready and the launch was postponed until Tuesday of this week; but the party were well repaid for their visit. The shops are probably the finest in this country; their arrangement and equipment is certainly admirable. They are lofty and light, and provided with the most modern tools and have an admirable outfit of cranes and trolleys for handling material. Within a short time the keels of two vessels, of 10,000 tons each, for the Pacific Improvement Co., will be laid down in these yards.

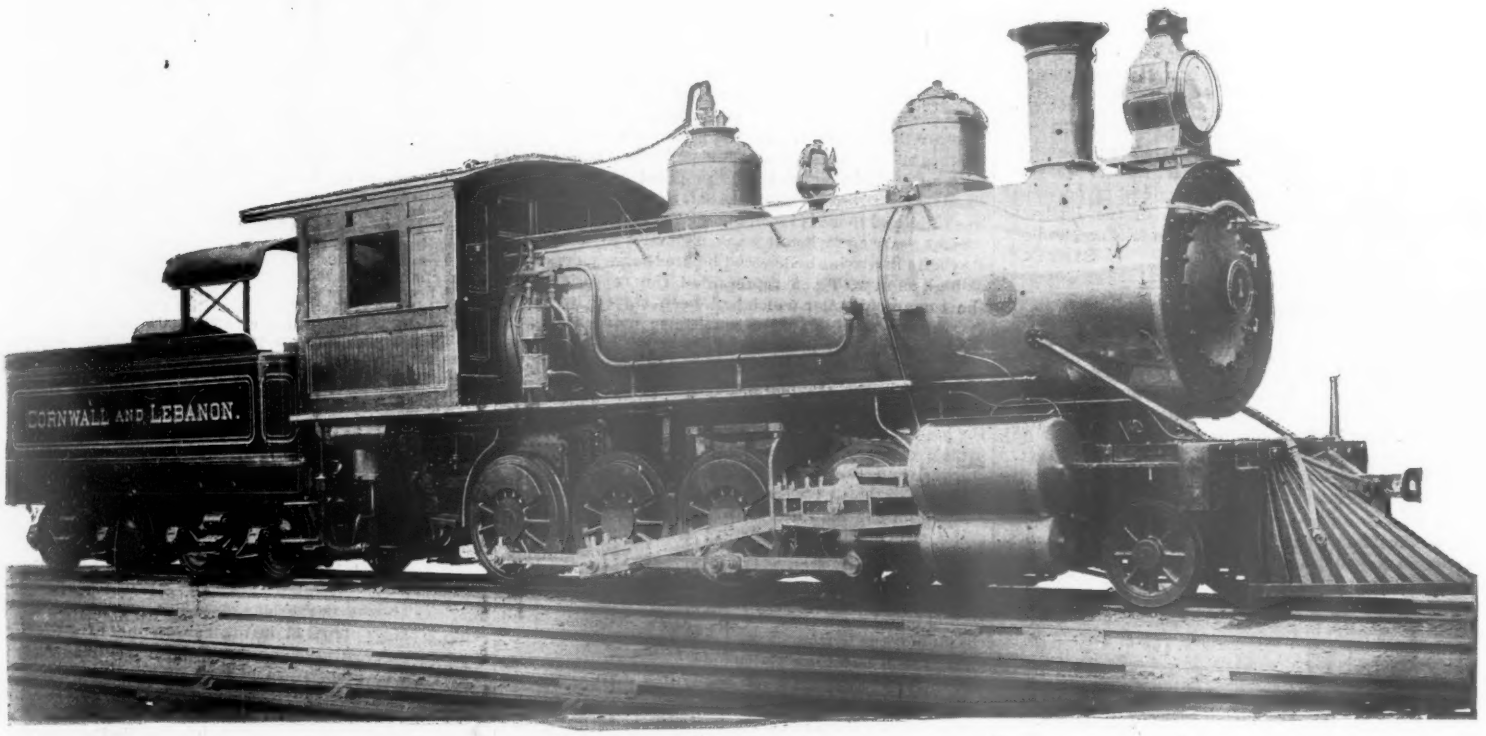
Some of the party went Saturday morning to see the iron coal pier of the Norfolk & Western Railroad which was described in a paper by W. W. Coe, M. Am. Soc. C. E.

The river bottom here is well adapted to the use of pile foundations. It consists of one to three feet of hard white sand, underlaid by a stratum of sandy marl, averaging 40 ft. in depth. A 7-in. pile penetrated this 18 in. from one blow of a 3,000 lb. hammer falling 15 ft. Below the marl is sand, but at some points the marl extends to a depth of 1,200 ft. The pier extends 805 ft., and is approached by a single track. There are, however, two delivery tracks (one each side of the pier), having a descending grade from the summit of 9 in. per 100 ft. There is a gravity return track between the delivery tracks with a grade of 2½ per 100.

Transfers from the delivery to the return tracks are made by two shifting tables with an end movement of 8 ft. overcoming a grade of 8 in. After these tables receive the empty cars they move by gravity to the line and grade of the return track, and the car runs down the latter. A counterbalance then brings the transfer back to place.

The foundations of the pier consist of hollow iron piles in bents 36 ft. apart, four piles in each. Vessels cannot come nearer than 8 ft. to the piles, being kept away by a pier protection of creosoted pine poles. These were put in place in advance of the iron piles, and a traveler used for sinking the latter (by means of a Worthington pump of 890 galls. per minute capacity) and also for erecting the superstructure.

Saturday afternoon a session of the convention was held and in the evening the banquet, took place. About 150 members and guests, including representatives of the army and navy attended the banquet. A few toasts were proposed by Toastmaster John Bogart, and responded to as follows: "George Washington," by Past President George S. Greene; "The American Society of Civil Engineers," by President Mendes Cohen; "The U. S. Army," by Col. R. T. Frank; "The U. S. Navy," by U. S. White, C. E., U. S. N.; "Our Sister Societies," by John C. Trautwine, Jr.; "Engineering Schools," by Professor C. B. Brush; "The Ladies," by George S. Morison. The ladies present voted their special thanks to F. C. Weir for his gift of bouquets for them, which has become a customary attention from him at the banquets.



COMPOUND CONSOLIDATION LOCOMOTIVE—CORNWALL & LEBANON RAILROAD.

Monday another session was held, although the party had begun to break up.

Resolutions of thanks were voted as follows: To Colonel Frank and all the officers of the post and artillery school for their kind reception; to Commander Weaver, of the U. S. Navy, and the officers of the Norfolk Navy Yard; to the officers of the Chesapeake & Ohio and the Norfolk & Western and New York, Philadelphia & Norfolk Railroads, and to the ladies whose presence contributed so much to the pleasure of the convention.

Special thanks were voted the General Committee of arrangements and to Colonel Craighill and the members of the Local Committee, which were acknowledged in a graceful response by Colonel Craighill. It was voted to present the library of Fort Monroe with a complete set of the *Transactions* of the Society and the future publications. It was, after considerable discussion, resolved that the Board of Directors be requested to consider the advisability of a new and more significant and more appropriate badge and to report to the Society at its next annual meeting.

Monday evening a considerable number of the members went by a special car on the Chesapeake & Ohio to West Virginia to see the work of the United States Engineers on the Kanawha River. They were accompanied by Col. Craighill, Corps of Engineers, U. S. A., on whose special invitation they went.

In closing this brief account of a very delightful gathering, the attractions of which cannot be enumerated in a concise and formal report, we ought not to forget to mention the extraordinary courtesy the officers of Fort Monroe showed to the Convention. Aside from the special entertainments which we have mentioned, the party was asked to visit the Fort at all times to see

guard mounting, dress parade, drill and other military ceremonies, and was shown over the laboratories of the artillery school, and the members were made free of the officers' club. These unusual hospitalities were thoroughly appreciated and enjoyed.

Compound Consolidation Locomotive for the Cornwall & Lebanon Railroad.

The illustration shows locomotive No. 1 built for the Cornwall & Lebanon Railroad Co. by the Baldwin Locomotive Works. The engine has the Vauclain compound cylinders, and is one of the largest, if not the largest, compound locomotive yet built. The following are the general dimensions:

Gauge, 4 ft. 8½ in.; cylinders, high pressure, 14 × 24 in.; low pressure, 24 × 28 in.; driving wheels, eight connected, 50 in. diameter; driving journals, 8½ in. × 9 in.; boiler, straight-top, 72 in. diameter, of ¾ in. steel, butt-jointed with double covering strips; working pressure, 180 lbs. per sq. inch.; firebox, 121⅞ in. ×42 in., adapted to burn soft coal; flues of iron, No. 13 wire gauge, 271 in number, 2¼ in. diameter, 13 ft. 6 in. long; wheel-base, total, 22 ft. 3 in.; driving wheel-base, 14 ft.; weight in working order, total, 150,000 lbs.; weight on driving wheels, 135,000 lbs.; truck wheels, 30 in. diameter, steel tired; truck journals, 5 in. × 9 in.; tender, 3,000 gallons capacity, with roof. This locomotive is fitted with the Coleman spark arrester, Nathan lubricator, United States metallic packing for piston rods and valve stems, balanced piston pattern slide valves, Sellers injectors, Crosby safety valves, headlight, asbestos lagging and the Westinghouse-American outside equalized air brake for driving and tender wheels, with duplex pump.

Passenger Car for Chicago Elevated Railroad.

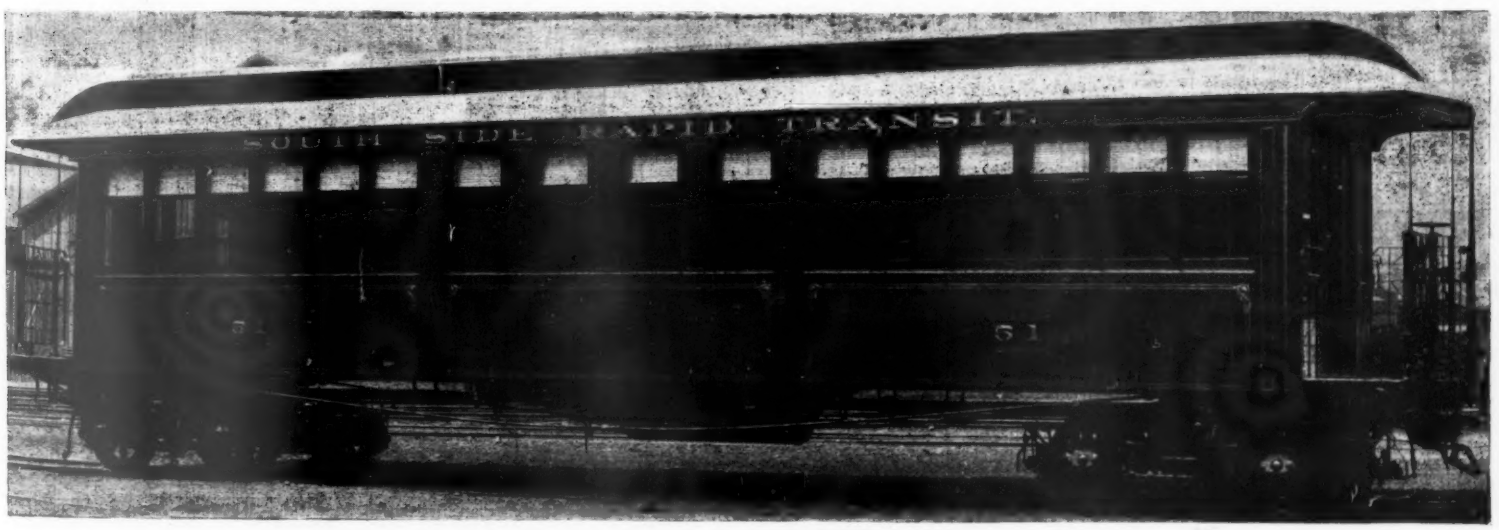
The engravings herewith show the exterior and interior of one of the new passenger cars for the "Alley" elevated road, Chicago. The first lot of cars was built by Jackson & Sharpe, Wilmington, Del. These illustrations are from one of the second lot of cars, which was built by the Gilbert Car Manufacturing Co., Troy, N. Y. Readers familiar with the cars used in New York city will notice that these are similar to those in the interior arrangements, with possibly even greater *hanging* capacity. They have, however, double end doors, both of which open whenever one handle is pulled. The decorations are of a light color, the general finish being light mahogany and the window shades whitewood. The cars are lighted by Pintsch gas and are equipped with the Westinghouse automatic air brake and the Gold car heating system.

They have Vauclain wrought iron wheels made by the Standard Steel Works. Every attention has been paid to the details in order to make them as durable as possible. The following are extracts from the specifications.

Length of car over all	45 ft.	11 in.
Extreme width	8 "	6 "
Height from bottom of sill to top of roof	9 "	6 "
Width of double-door openings	3 "	6 "
Distance, centre to centre of trucks	32 "	6¼ "
Centre of truck to end of platform	6 "	9¾ "
Weight of car empty, about	28,000 lbs.	

The draw bars are Hain & Pollock's design, and the gates are the New York Safety Gate Co.'s pattern.

Car for the Chicago & South Side Rapid Transit Railroad.



Car for the Chicago & South Side Rapid Transit Railroad.

Emergencies on Railroads.*

A great deal has been published on the subjects of construction and maintenance of way of railroads, much of which seems to the author very useful and a great deal of which is of little or no value to the average engineer. Having, however, had much experience in the class of work upon which he proposes to write, he has concluded to venture, hoping that what he has to say may be found of use to some members of the engineering profession who may be called on "in an emergency."

What to do in an Emergency.—Of course, we should have no emergencies, but should be fully prepared for any contingencies that may arise. No doubt, we would be so prepared, but our finance committees, boards of directors, presidents, general managers and treasurers are sometimes not able to see, or if able to see, not willing to allow "a stitch in time." A few practical hints will be given by the writer, who regrets to have to acknowledge that he has frequently had to learn by experience to act very promptly, when at the same time he was very poorly equipped for his work.

Removal of a Wreck on Ordinary Cut or Fill when the Track is Obstructed.—The first object is to open the road to traffic. The next is to decide which cars and materials are worth saving and to work with this end in view, cutting up such wreckage as may seem worthless, so that it can be the more easily removed. Then place "dead men," or select trees or other stable objects if they can be found in proper position from the wreck and sufficiently rigid, to be used as fixed points to which to attach snatch blocks. These are to be rigged with 2-in. manilla ropes, or larger if necessary, which are to be attached to a locomotive and also to such parts of the wreck as it may seem best to draw out. A wire rope should be used in taking hold of the wreckage, this being hitched on to the manilla rope for this purpose.

Removal of a Wreck Occasioned by the Fall of a Bridge.—1st. Decide what is worth trying to save and remove it as soon as possible.

2d. Measure at once the height necessary for a trestle; and if there are timbers on hand that will answer for such purposes, order them up at once; if not, make arrangements to have them cut and delivered promptly, ordering about 50 per cent. more of heavy timbers and about double as much bracing plank, 2 and 3 in. thick, from 16 to 30 ft. long—as the net estimate calls for. The surplus will be needed for scaffolding, etc. If logs of from 12 to 18 in. diameter can be obtained, they will answer better than square timber for posts, and be much more economical. If practical, have half of the material delivered on each end of the wreck.

3d. If in a river or other water where boats can be used to advantage, start a carpenter force to work immediately at making three boats about 8 × 26 ft., as per sketch, fig. 2, and one rowboat about 2½ × 18 ft., if you have no such boats on hand. One large boat is to be used in transporting men and material, the other two as described below.

4th. Order a telegraph operator to the spot at once and open an office near your work.

5th. Estimate what forces are needed, according to your best judgment, and order them to be hurried to the work.

6th. If the case is one where you will be detained several days, divide the force up into day and night squads, and order the squads not at work to keep out of the way, and to report promptly at a designated hour.

7th. The distribution of forces should be, a squad of about twelve carpenters at each end of the bridge for framing and raising; a squad of about twenty laborers with an intelligent foreman, to attend each carpenter force to supply it with materials, and to furnish additional assistance to handle heavy materials.

8th. Be sure to have plenty of 6 and 8-in. spikes, both cut and wrought; drift bolts about 22 × ¾-in. or ⅝-in. diameter, and ordinary screw bolts ⅝ and ¾ in. diameter and 24 in. long, with nuts and cast washers.

9th. A good force should be started promptly on the work, chipping with cold chisels and loosening bolts here they are likely to hang, so that the parts can be

* Extracts from a paper by Channing M. Bolton, M. Am. Soc. C. E., presented at the Old Point Comfort Convention.

pulled out in detail. 10th. Stretch a rope, if possible, across the stream, to be used as a guide to the boats in taking men and materials backward and forward.

11th. Under certain circumstance the wreck can be handled by an engine on the main track, with snatch blocks heretofore described: but usually it is best to build a temporary track down the hillside to the bottoms, and then turn this track on the bottom, down or up stream as may be found best; the engine is then in position to do the most effective work, either working directly with ropes attached to parts of the wreck or by passing ropes through snatch blocks as described and then to the wreck.

12th. When night work is to be done, arrange during the day for proper lights, and place them in charge of an intelligent man detailed for this purpose. The author has found the Wells lights very satisfactory; the ordinary gasoline lamp, such as is used at fruit stands, etc., is also very useful. This is in case no electric plant, such as is hereafter described, is to be had.

13th. After the wreck is removed, the next step is to raise the trestle. Place lever arm timbers, 12 × 12 in., about 30 ft. long, with sheaves set in them at about 2 ft. from the ends, and fasten double block with 1-in. rope falls about 1 ft. from the ends, so that the outer ends of the timbers will be directly over the position at which it is desired to set the post. Support the lever arm timbers at a point near the centre, at the proper distance from the sheave, on the abutment or next trestle; block it up, so as to raise the sheave ends of the timbers about 2 ft. above the top of the caps; then secure the inner ends of the lever timbers, so that they will withstand the leverage when lifting timbers at the outer end. Having fastened guide planks to two of the large boats (which planks should project from one side of the boats, so as to make the distance from their ends to the far side of the boat the distance desired between the trestle bents), place the boat with the current, allowing the ends of the guide planks to rest against the abutment; this will place the outer side of the boat in the proper position for the first bent. Then float the trestle post about under the position in which it is to be set, having a chain or rope sling placed around it a short distance above its centre of gravity, and raise it with the fall rope until the lower end is above the surface of the water; then loosen the fall rope, dropping the post in the proper position on the bottom, using the outer side of the boat for a guide.

After the first post is set on the bottom, run a 3-in. plank out from the abutment, spike the outer end to the post, plumb the post, and fasten the outer end of the projecting plank to the abutment. Then raise the other three legs of the bent in like manner, raising the two centre posts first, righting them up, and bracing them laterally to each other as soon as raised. After having raised the two centre posts of the first bent, spike a guide plank to one side, of a length sufficient to take in all four posts when raised, being careful to have the upper edge placed perfectly horizontal and about 24 in. below the position that the lower chord of the permanent bridge will occupy. Place two lines of horizontal braces of about 3 × 12-in. plank about 4 ft. below the top of the caps, on the outsides of the centre posts and parallel to the axis of the bridge; these will act both as bracing and scaffolding for the carpenters. Then saw off the tops of the posts flush with the top of the guide plank; place the cap (which should be 22 ft. long in order to use it as false work in raising the permanent bridge) on top of the posts and drift bolt it to them with bolts of ⅝ or ¾ in. diameter and 22 in. long, and block up on top of the caps to the proper height for stringers. When the first bent is raised and properly braced, move the "guide boat" and lever arms forward, using the first bent in the same manner as the abutment was used in the start and so on until the forces working in the same way from the other end of the span are met.

14th. Block up on on the caps to the proper height and put stringers, cross-ties and rails in place.

15th. The above description is for cases where the height is not too great for a single deck trestle. Where additional height is required, while part of the carpenter force is raising the first deck, others should frame the second deck, having determined its height by deciding to what height the first deck will be built.

16th. In cases where there is little or no water the above described method may be used for clearing the wreck, but raising the trestle is simplified by framing bents to the proper height and raising them by use of ropes attached to a locomotive.

An engineer should take charge of the work himself, and it should be understood that there is but one man in charge. He should see that his forces never have to wait for materials after the work has been started. These notes are suggestive in case of an emergency and when an engineer is poorly prepared to meet it. A memorandum is given below of such things as every company should have at a convenient position on its line, and which, in the above described contingencies, will make the task much easier. [We omit this list.]

Tests of Illinois Central Suburban Locomotive.

Mr. Henry Schlacks, Superintendent of Machinery of the Illinois Central road, has been making some investigations into the various means of reducing the smoke nuisance. The pressure brought to bear upon the Illinois Central by the citizens of Chicago is very great; the road runs along a thickly settled part of the city, containing many beautiful residences, and the locomotives burn bituminous coal and make large quantities of smoke. Among other investigations made by Mr. Schlacks is one about engines using anthracite pea coal instead of bituminous coal. The Philadelphia & Reading Coal & Iron Co., desiring to increase the market in Chicago for anthracite coal, has constructed a suburban locomotive with a Wootten boiler and Vauclain compound cylinders from joint designs of Mr. L. B. Paxson, Superintendent of Motive Power of the Philadelphia & Reading road and the Baldwin Locomotive Works. Several of the engines were first run and are now running on the Reading road, where they are successfully hauling heavy suburban trains. The tests on the Illinois Central were made by an engineer of tests from the Chicago office of Mr. D. L. Barnes, of the *Railroad Gazette*. The description of the engine tested and the results of the tests are given in what follows:

The locomotives tested were: (*A*) Vauclain compound Wootten suburban, No. 623, built by the Baldwin Locomotive Works; (*B*) Illinois Central standard suburban, No. 211, built by the Illinois Central road at the Weldon shops; (*C*) Illinois Central six-wheel switcher, No. 130 used in suburban service, built by the Rogers Locomotive Works. These engines were tested to determine the comparative amounts of anthracite and bituminous coal used in suburban passenger and freight service. The results give:

(*a*) Average number of cars per train.
(*b*) Total amount of coal used.
(*c*) Total amount of water used.
(*d*) Total miles run.
(*e*) Total car miles.
(*f*) Ton miles (cars and lading only).
(*g*) Total ton miles, locomotive included.
(*h*) Water evaporated at boiler pressure per pound of coal used.
(*i*) Equivalent evaporation from and at 212 degrees.
(*j*) Coal used per mile run.
(*k*) Coal used per car mile.
(*l*) Coal used per hundred ton miles (train and lading only).
(*m*) Coal used per hundred ton miles (weight of locomotive included).
(*n*) Indicator cards.
(*o*) Speed recorder diagrams.
(*p*) Smokebox temperatures.
(*q*) Smokebox vacuum.
(*r*) Priming of boilers.
(*s*) Comparative cost of anthracite pea coal and bituminous coal for hauling suburban trains.

APPARATUS USED.

Water Meters.—Water was measured by a 2-in. Thomson water meter placed between the tank and injector. Between the meter and injector a check valve is so placed as to allow no hot water to be blown back from injector to meter. The meter was calibrated from tank measurements while on engine No. 623 by taking readings with a full tank of water and another after tank was nearly empty, when the depth of water remaining in the tank was noted and the meter reading checked from tank drawings. The two were found to agree within .2 per cent., which shows that the meter may be depended upon for close work.

Injectors.—The amount of water wasted at overflow was determined by trial for each of the different injectors used, and proper allowance made in calculations.

Coal Measurements.—The coal measurements were made by weighing into sacks holding 200 lbs. and emptying into the tender nearly enough for the run to be made, and piling enough on in bags to complete the run. In order that no coal should be charged to the engine until starting, enough coal was placed in the cab separate from that to be used upon the run to keep the fire up until starting, when the condition of the fire was noted. Coal was then taken from the tender, and at the end of the run the fire brought to the same condition as nearly as was possible. This was necessarily a matter of judgment, and somewhat unsatisfactory in the case of compound engine No. 623, owing to the character of the fire, which at starting was usually thinly and evenly spread over the grate, while after a run of 40 or 50 miles the grate was covered with a bed of ashes and clinkers on top of which lay a bed of fire of varying thickness. These conditions, together with the large area of grate, combined to render the coal measurements somewhat inaccurate. The error from this cause was probably not over 300 lbs., though this amount on a run to Harvey and return would mean an error of about 5 per cent., as shown by the fuel account. It is, however, difficult to see how a more accurate measurement could be made by any other method.

Pyrometer.—A 900 degree pyrometer was placed in the smokebox just in front of the netting, and about 8 ins. away from the tube sheet, with the dial in such position that the man at the indicator could note variations in smoke-box temperature.

Vacuum Gauge.—The vacuum gauge consisted of a U-shaped glass tube partly filled with water, with a sliding scale, upon which the differences in height of the two water columns could be read directly. The upper end of one tube was left open and the other connected with the smokebox opposite the nozzle by ⅝ in. rubber tubing.

Indicator.—A Tabor indicator was used in all the tests, and motion for the drum taken from the crosshead by a pantagraph made for the purpose and connected to running board.

Calorimeter.—The calorimeter was of the type first used on the test of the Baldwin 10-wheeler upon the Baltimore & Ohio railroad in May, 1891, and described in the *Railroad Gazette*, Nov. 27, 1891. This is a simple instrument and very sensitive, as the bulb of the thermometer is exposed to the steam so that any variation of pressure or change in the quality of the steam is almost instantly shown. It was placed in the dome opposite the throttle valve, as it was believed that in this position only would it receive steam in the condition in which it leaves the boiler and unaffected by any possible condensation or superheating in the steam pipe.

Speed Recorders.—Two Boyer speed recorders were used: one a standard machine running ½ in. of paper per mile, which was used on freight and passenger runs; the other a machine made especially for suburban work running 12 in. per mile. Both recorders were satisfactory, but the second one was found to be of especial value in suburban work, showing as it did the manner in which the train was accelerated, as well as more accurately the speed attained at all points between stations.

Communication.—Communication was maintained between those engaged in the test by means of speaking tubes conveniently located. In this way indicator cards were ordered and steam pressure given to the men at the indicator and calorimeter as often as desired.

Fuel Used.—The first car of anthracite pea coal used by Engine No. 623 was from Boston Run and the remainder from Preston No. 3 colliery. The bituminous pea used was Illinois coal of an ordinary quality. The bituminous coal used on final test runs of Engines No. 211 and No. 130 was from the Carbondale mines of the Kentucky Coal Mining Co.

It was the intention to make as many consecutive runs as possible, and to give the engines to be tested as many cars as could be hauled making time between terminals. It was found to be impossible to give the engine regular consecutive runs, and on account of a scarcity of cars on the first and third runs, these were finally abandoned and only one run made per day.

TESTS OF COMPOUND LOCOMOTIVE NO. 623.*

General Dimensions.

High pressure cylinder, diam.	12 in.
Low " " "	20 "
Length of stroke	24 "
Driving wheels, diam.	61⅝ in.
Driving wheel base	11 ft.
Total " "	35 "
Weight in working order, about	158,000 lbs.
Weight on drivers in working order, about	91,000 "
Diameter of boiler	60 in.
Number of flues	321
Diameter of flues	1½ in.
Length of flues	9 ft.
Firebox	114 × 80 in.
Length of combustion chamber	36 in.
Type of firebox	Wootten.
Diameter of truck wheels	29¾ in.
Tank capacity	2,000 galls.
Heating surface, firebox	121 sq. ft.
" " combustion chamber	40 "
" " flues	1,121 "
" " total	1,285 "
Grate surface	63.3 "

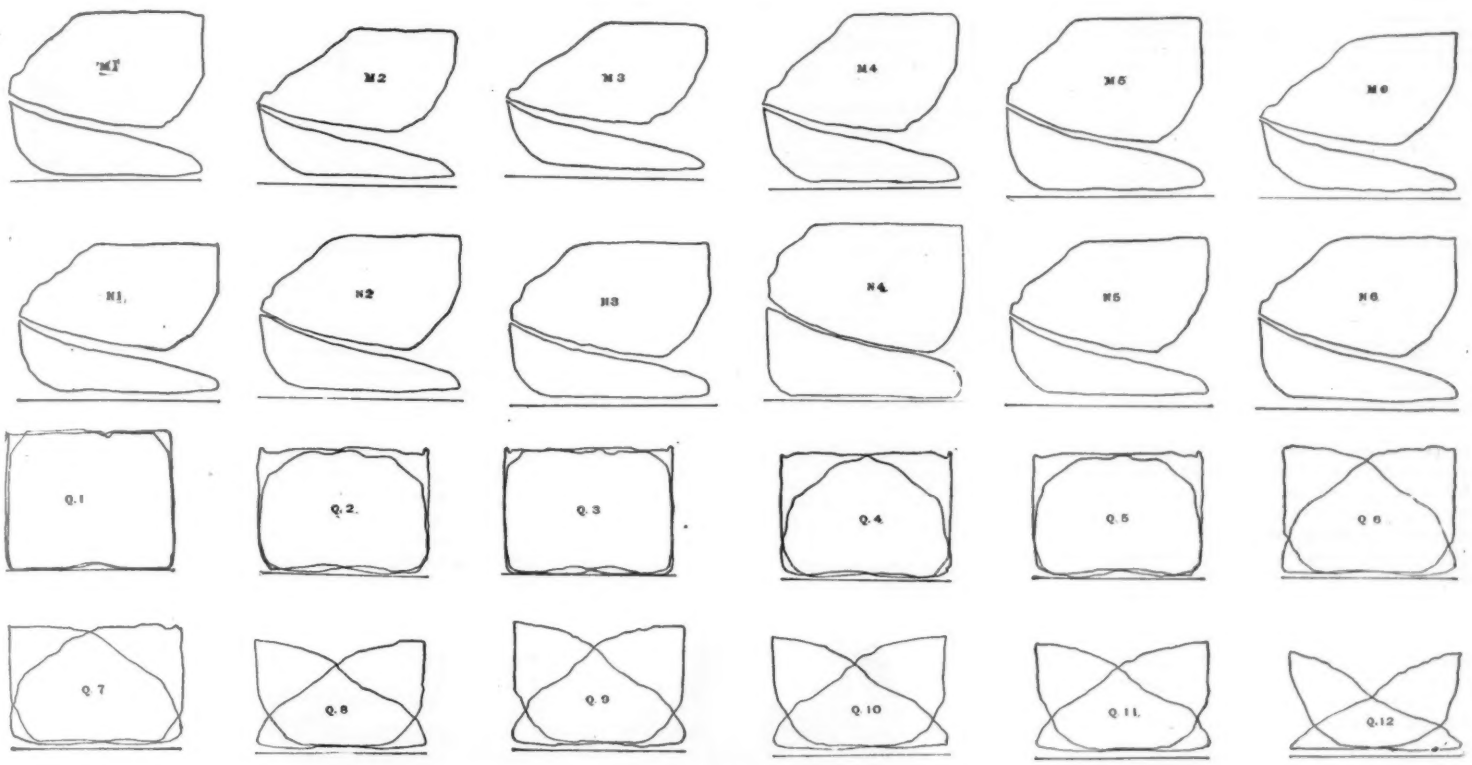
This engine has the Wootten boiler, but with a single cab at the back of the engine instead of having an engineer's cab ahead of the firebox, as is usually the case. There is a variable nozzle, with a maximum opening of 5¼ in. The engine was handicapped by overweight, being designed for a weight on drivers of 72,000 lbs. and with cylinders for that weight. A series of preliminary runs was begun on April 5 with this engine in order to determine the most favorable conditions of operation and allow those in charge to become accustomed to the working and firing of the engine. Trials were made of hard coal, soft coal and a mixture of hard and soft, and trains of from four to sixteen cars were hauled. The final runs were made on April 23, 26 and 27, with train No. 31 to Harvey and No. 68 back to Chicago. The safety valve was set to blow off at about 195 lbs. pressure.

Date	23	26	27
Left Chicago	10:40	10:15	10:40
Delays	7 min.	4 min.	6 min.
Arrived at Harvey	11:43	11:42½	11:43
Left Harvey	11:51	11:51	11:51
Delays	2 min.	.....	.....
Arrived at Chicago	1:03	1:00	1:03
Average steam pressure	168	183	186
Average temperature	60°	40°	46°
Direction of wind	West	Northeast	East
Weather	Cloudy	Cloudy	Cloudy
Condition of rail	Dry	Dry	Dry
Feed water temperature	49°	51°	50°
Number of cars	15	14	15
Coal used, pounds	5,025	5,040	4 930
Water used, "	22,863	2?,781	23.367
Miles run	39 24	39.24	39.24
Car miles	588.6	549.4	588.6
Ton miles, train	9784.5	9166.8	9784.6
Total ton miles	12,884	12 267	12,884
Actual evaporation	456	452	479
Equivalent evaporation	5.62	5.56	5 90
Coal used per mile, lbs	128	128.4	125.5
Water used per mile, lbs.	583.68	580 37	601.0
Coal per car mile, lbs	8.53	9.17	8.37
Water per car mile, lbs.	38.90	41.45	40.10
Coal per 100-ton miles, train lbs.	51.35	54.97	50.38
Water per 100-ton miles, train lbs.	234.16	248.46	241 32
Coal per 100-ton miles, total lbs	38.90	41.00	38.10
Water per 100-ton miles, total lbs	177.38	185.32	182.50

With anthracite pea and bituminous coal, mixed half and half, the engine smoked quite badly, especially on heavy trains, when firing was frequent and heavy. On light trains the smoke could be controlled to a considerable extent by the blower. The engine was laid up on April 10, and the front of the grate bricked over about 3 ft. back. The first trip on April 11 was made with this arrangement. No great difference in the smoking of the engine was noticed, though the change seemed to slightly lessen the smoke.

On April 11 two runs were made with bituminous pea coal. The first, a train of 15 cars to Harvey, hauling one Pullman sleeper to Kensington, and the second a regular train of five cars to Homewood. On the first trip the engine left Central Depot with a clear fire and making little or no smoke. A few shovels of coal at Van Buren street resulted in a dense cloud of smoke, which had quite perceptibly abated at Twelfth street. Firing was invariably followed by heavy smoke, upon which neither the exhaust nor blower had any effect for some time. With lighter trains the smoke was lessened, though still quite noticeable. It is but fair to state that this boiler was not expected to burn soft coal with the grate then in use, and that the brick with which a part of the grate was covered was put in, not with a view of preventing smoke entirely, but with a hope of abating it.

*This engine was described in the *Railroad Gazette*, April 1, 1892.



TESTS OF ILLINOIS CENTRAL SUBURBAN LOCOMOTIVE—INDICATOR DIAGRAMS.

TESTS OF ILLINOIS CENTRAL ENGINE NO. 211.

This engine is the standard Illinois Central engine for suburban service. It is of the Forney type with four drivers, a leading two-wheeled truck, and a four-wheel trailing truck. It has the ordinary straight top boiler with extension front and straight stack. The following are some of the principal dimensions:

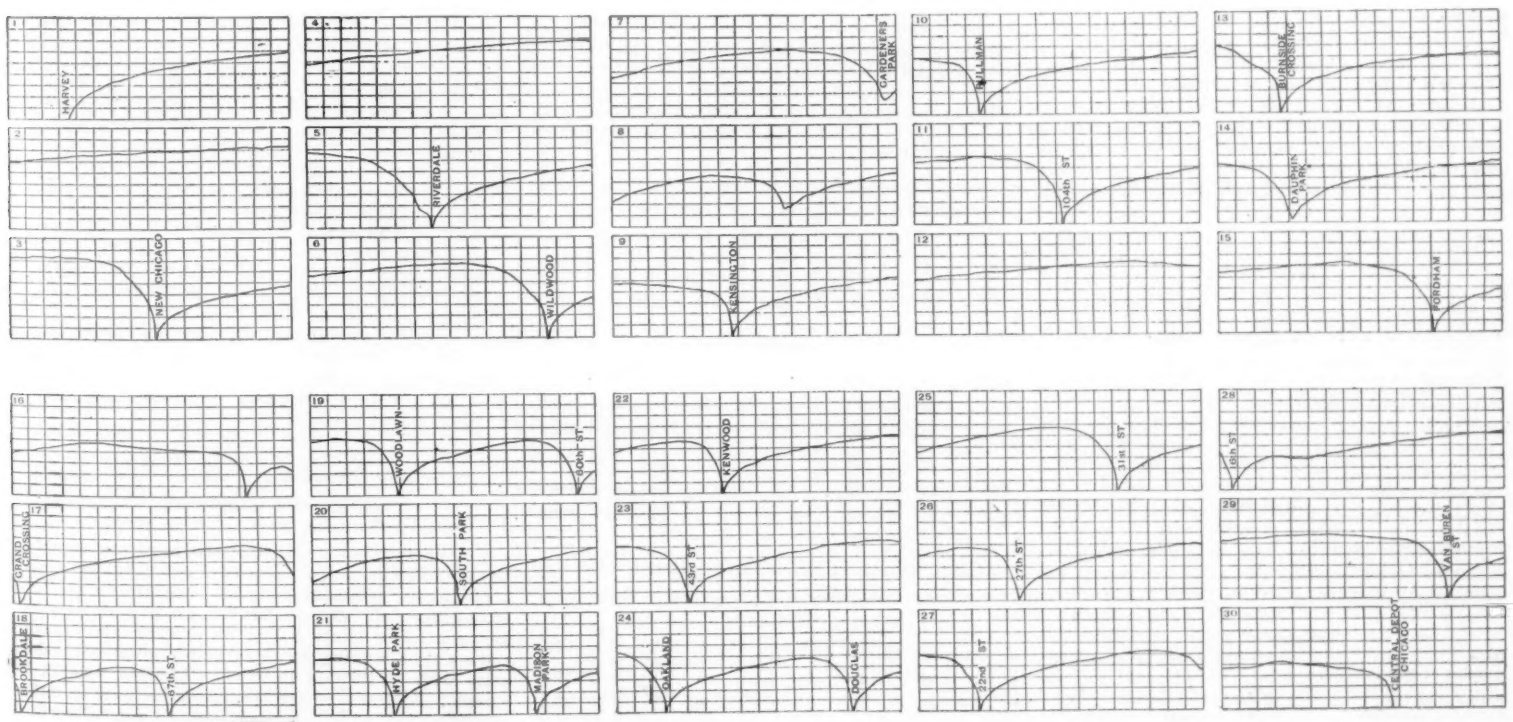
Diameter of cylinder	16 in.
Length of stroke	22 in.
Steam ports	1¼ × 14½ in.
Exhaust ports	2½ × 14½ "
Lap	⅞ in.
Travel of valve	5 in.
Diameter of drivers	56½ in.
Rigid wheel base	7 ft. 0 in.
Total wheel base	31 ft. 9½ in.
Length over all	47 ft. 2⅝ in.
Diameter of boiler	50 in.
Firebox	34⅛ × 58⅛ in.
Number of flues	153
Diameter of flues	2 in.
Length of flues	11 ft. 0½ in.
Firebox heating surface	95 sq. ft.
Flue heating surface	881 sq. ft.
Total heating surface	979 sq. ft.
Grate area	14 sq. ft.
Weight on drivers	56,100 lbs.
Weight on leading truck	14,600 "
Weight on trailing truck	46,500 "
Total weight	117,200 "
Water capacity	1,540 galls.
Coal capacity	3½ tons.

This engine was equipped with the apparatus used in the test of No. 623, and trips made upon May 6 and 7 with a train of 12 cars. It was found impossible to make time with the coal burned, which was an inferior grade of Illinois bituminous. The smokebox would invariably be found about half full of cinders at the end of a 20-mile run. A good quality of Carbondale coal was then procured and trips made on May 9, 10, 11, 16 and 17. The run of May 9 was made with 12 cars. On May 10, with 15 cars, the right hand injector was found too small to supply sufficient water, and the left hand injector used. There being no water meter upon the left side, the run was thrown out and a larger injector placed upon the engine. The run of the succeeding day was thrown out because of an uncertainty regarding the amount of coal burned.

Date.	May 9.	May 16.	May 17.
Left Chicago	10:41½	10:40	10:40
Delays	5 min.	3 min.	3 min.
Arrived at Harvey	11:44	11:44	11:43
Left Harvey	11:51½	11:52	11:51½
Delays	.....	.....	.....
Arrived at Chicago	1:04½	1:09¼	1:04
Average steam pressure	137	131	136
Average temperature	44	59	59
Direction of wind	N. E.	S. W.	S. E
Weather	Cloudy	Clear	Cloudy

Date.	May 9.	May 15.	May 17.
Condition of rail	Dry	Dry	Dry.
Feed water temperature	52°	51°	52°
Number of cars	15	15	12
Coal used, lbs.	5,400	6,719	6,253
Water used, lbs.	21,403	23,050	22,689
Miles run	39.24	39.24	39.24
Car miles	588.6	588.6	470.9
Ton miles, train	9,784.5	9,784.5	7,871
Total ton miles	12,099 6	12,099 6	10,186.2
Actual evaporation	3.93	3.43	3.63
Equivalent evaporation	4.83	4.18	4.43
Coal used per mile, lbs.	137.6	171.3	159.4
Water used per mile, lbs.	574.9	587 55	546 7
Coal per car mile, lbs	9 17	11.42	11.38
Water per car mile, lbs.	35.67	39.17	41.30
Coal per 100 ton miles, train, lbs.	55.18	68.56	80.72
Water per 100 ton miles, train, lbs.	214.65	235.16	233.01
Coal per 100 ton miles, total lbs	44.63	55.53	61.39
Water per 100 ton miles, total lbs	176.73	190.47	222.84

The vacuum in the smokebox ran to about 7 or 8 in. when the engine was working hard. The temperature of the smokebox averaged about 900°, dropping below at times and running higher when the engine was crowded. The boiler showed from 1 to 4 per cent. of priming when running at high speed with late cut-off and boiler well filled with water.



TESTS OF ILLINOIS CENTRAL SUBURBAN LOCOMOTIVE—SPEED RECORDER DIAGRAMS.

Each vertical division represents five miles an hour; each horizontal division represents 220 ft.

SIX-WHEEL SWITCHING ENGINE NO. 130.

This engine was built by the Brooks Locomotive Works for a switching engine, and is used at present by the Illinois Central on suburban passenger trains. The following are some of the principal dimensions:

Diameter of cylinders	18 in.
Length of stroke	24 in.
Steam ports	1½ × 16 in.
Exhaust port	2⅝ × 16 in.
Slide valve	Richardson.
Travel of value	5¼ in.
Lap	¾ "
Lead	1/32 "
Diameter of drivers	54 "
Diameter of boiler	54 "
Firebox	33⅞ × 77 3/16 in.
Number of flues	206
Diameter of flues	2 in.
Length of flues	9 ft. 7 1/16 in.
Firebox heating surface	106½ sq. ft.
Fine " "	1,033½ "
Total " "	1,140 "
Grate area	18.25 "
Weight on drivers	84,000 lbs.
Total weight	144,000 "
Water capacity	2,400 galls.
Coal capacity	About 4 tons.

This engine was fitted with a double nozzle 3½ in. diameter bridged with ½ in. round iron. It was found to be impossible for this engine to make steam with the coal generally used and haul a heavy train. Several preliminary runs were made and changes made in the adjustment of the valve and in the smokebox before the final test runs were commenced. The test runs were made on May 26 and 28, and June 2. The run on May 26 was made with twelve cars; those of May 28 and June 2 with fifteen cars. The water consumption for the run of May 28 is not given. Meter readings were kept by an employé whose notes for that day were lost. This engine was fitted with all the apparatus used in the two preceding tests with the exception of the pyrometers.

The speed recorder was placed under the tender and belted to a truck axle. It was impossible to place a speed dial where it could be read by the man at the indicator. The point on the road at which indicator cards were taken was noted carefully and the speed at that point taken from the speed recorder diagram after the run was over. The safety valve was set at 155 lbs. Below are given the results of the runs of May 26 and 28 and June 2:

Date	May 26.	May 28.	June 2.
Left Chicago	10:40	10:41	10:40
Delays	4½ min.	3 min.	6 min.
Arrived at Harvey	11:39½	11:44	11:43
Left Harvey	11:50	11:52	11:51
Delays	.....	....	2 min.
Arrived at Chicago	1:01½	1:02	1:07
Average steam pressure	136	128	120
Average temperature	60	60	58
Direction of wind	W.	S.	N.
Weather	Cloudy	Cloudy	F. ggy
Condition of trial	Dry	Damp	Damp
Feed water temperature	52°	51°	52°
Number of cars	12	15	15
Coal used, lbs	5,778	6,759	7,110
Water used, lbs	22,517	.....	24,403
Miles run	39.24	39.24	39.24
Car miles	470.9	588.6	588.6
Ton miles—train	7,871.	9,784.5	9 784.5
Total ton miles	10,696	12,620	12,620
Actual evaporation	3.89	.....	3.43
Equivalent evaporation	4.74	.....	4.17
Coal used per mile, lbs	147.24	172.24	181.19
Water used per mile, lbs	572.76	.....	621.48
Coal used per car mile, lbs.	12.27	11.48	12.08
Water used per car mile, lbs.	47.73	.....	41.43
Coal per 100 ton miles—train, lbs	73.41	69.07	72.66
Water per 100 ton miles—train, lbs	285.56	.....	249.22
Coal per 100 ton miles—total lbs	54.02	53.56	56.34
Water per 100 ton miles—total, lbs	210.14	.....	493.25

The vacuum in the smokebox of this engine ran to 8 and 9 in. when doing heavy work. No priming was shown by the calorimeter at any time.

AVERAGES.

Below are given in tabulated form the results of the final test runs. The tables give the actual cost of coal per mile, coal per car mile, coal per 100 ton miles for train (back of tender), and coal per 100 ton miles for total trains—engine and tender included—and based upon the actual cost of coal on tenders, which is as follows:

Anthracite pea, per ton	$2.85
Bituminous coal, per ton	1.85

Engine No. 623.

Date	Apr. 23.	Apr. 26.	Apr. 27.
No. of cars	15	14	15
Coal used, anthracite, lbs	5,025	5,040	4,930
Water used, lbs	22,868	22,871	23,367
Actual evaporation	4.56	4.52	4.79
Equivalent evaporation	5.62	5.56	5.90
Water used per mile, lbs	583.68	580.37	601.06
Water used per car mile, lbs.	38.90	41.45	40.10
Water used per 100 ton miles, train lbs	234.16	248.46	241.32
Water used per 100 ton miles, total lbs	177.38	185.32	182.50
Coal used per mile, lbs	128.00	128.40	125.50
Coal used per car mile, lbs.	8.53	9.17	8.37
Coal used per 100 ton miles, train lbs	51.35	54.97	50.38
Coal used per 100 ton miles, total lbs	38.90	41.00	38.10
Cost of coal per mile, cts	18.240	18.298	17.885
Cost of coal per car mile, cts.	1.2155	1.3057	1.1927
Cost of coal per 100 ton miles, train cts	7.3163	7.8315	7.1995
Cost of coal per 100 ton miles, total cts	5.5425	5.8413	5.429

Engine No. 211.

Date	May 9	May 16	May 17
Number of cars	15	15	12
Coal used, bituminous, lbs	5,400	6,719	6,253
Water used, lbs	21,403	23,050	22,689
Actual evaporation	3.96	3.43	3.63
Equivalent evaporation	4.83	4.18	4.43
Water used per mile, lbs	574.90	587.55	546.70
Water used per car mile, lbs.	35.67	39.17	41.30
Water used per 100 ton miles—train, lbs	214.65	235.16	293.01
Water used per 100 ton miles—total, lbs	176.73	190.47	222.84

Engine No. 211.

Date	May 9	May 16	May 17
Coal used per mile, lbs	137.60	171.30	159.40
Coal used per car mile, lbs	9.17	11.42	11.38
Coal used per 100 ton miles—train, lbs	55.18	68.56	80.72
Coal used per 100 ton miles—total, lbs	44.63	55.53	61.39
Cost of coal per mile, cts	12.728	15.85	14.746
Cost of coal per car mile, cts.	0.8482	1.0563	1.0527
Cost of coal per 100 ton miles—train, cts	5.1020	6.3420	7.4665
Cost of coal per 100 ton miles—total, cts	4.1285	5.1300	5.6790

Engine No. 130.

Date.	May 26.	May 28.	June 2.
Number of cars	12	15	15
Coal used, bituminous, lbs	5,778	6,759	7,110
Water used, lbs	22,517	.....	24,403
Actual evaporation	3.89	.....	3.43
Equivalent evaporation	4.74	.....	4.17
Water used per mile, lbs	572.76	.....	621.48
Water used per car mile, lbs	47.73	.....	41 43
Water used per ton miles, train, lbs	285.56	.....	249.22
Water used per 100 ton miles, total, lbs	210.14	.....	193.25
Coal used per mile, lbs	147.24	172.24	181.19
Coal used per car mile, lbs	12.27	11.48	12.08
Coal used per 100 ton miles, train, lbs	73.41	69.07	72.66
Coal used per 100 ton miles, total, lbs	54.02	53.56	56.34
Cost of coal per mile, cts	13.62	15.93	16.76
Cost of coal per car mile, cts.	1.135	1.062	1.117
Cost of coal per 100 ton miles, train, cts	6.791	6 389	6.722
Cost of coal per 100 ton miles, total, cts	4.997	4.954	5.212

In the following table are given the various detail measurements taken from the indicator cards illustrated with this. The numbers on the cards refer to numbers in the tables.

The speed recorder diagrams explain themselves. They are interesting as being the first ever taken on such a large scale, viz.: 12 in. of paper per mile run. Each vertical division corresponds to a speed of five miles an hour. The horizontal spaces correspond to 220 ft. length of track, the paper being stationary when the engine is not moving.

Sheet M. Compound Engine No. 623. Chicago to Harvey.

Card No.	Speed.	Steam Pressure.	Cut-Off.	Back Pressure.	Average M. E. P.	Indicated H. P.
			Notch.			
1	25	180	2	6	H. 84.0 / L. 36.8	697.4
2	34	175	1	10	H. 68.0 / L. 28.8	754.0
3	37	150	2	11	H. 68.8 / L. 28.8	824.8
4	28	190	2	8	H. 79.2 / L. 33.6	761.1
5	25	190	2	9	H. 90.4 / L. 40.0	754.6
6	34	175	2	9	H. 72.0 / L. 28.0	762.9

Sheet N. Compound Engine No. 623. Harvey to Chicago.

			Notch.			
1	30	160	2	11	H. 75.2 / L. 33.6	757.6
2	28	174	3	11	H. 81.2 / L. 35.2	750.7
3	25	170	3	10	H. 82.4 / L. 36.0	683.0
4	19	181	4	6	H. 98.4 / L. 49.6	671.7
5	28	180	3	13	H. 79.2 / L. 33.6	723.8
6	25	180	2	11	H. 82.4 / L. 36.8	691.7

Sheet Q. Simple Engine No. 211. Chicago to Harvey.

			Inches.			
1	2	147	20	2	127.0	57.50
2	6	140	17	7	112.0	168.63
3	10	140	20	4	112.0	297.70
4	10	140	15	6	100.0	265.80
5	17	135	16.5	6	102 0	460.20
6	18	138	12	4	92.2	440.6
7	20	133	12.5	6	91.0	483.8
8	22	127	11	5	70.2	386.7
9	25	135	10.5	5	80.6	535.1
10	30	130	11	6	70.2	568 2
11	31	131	10.5	7	67.0	521.0
12	36	132	8.5	5	51.5	403.6

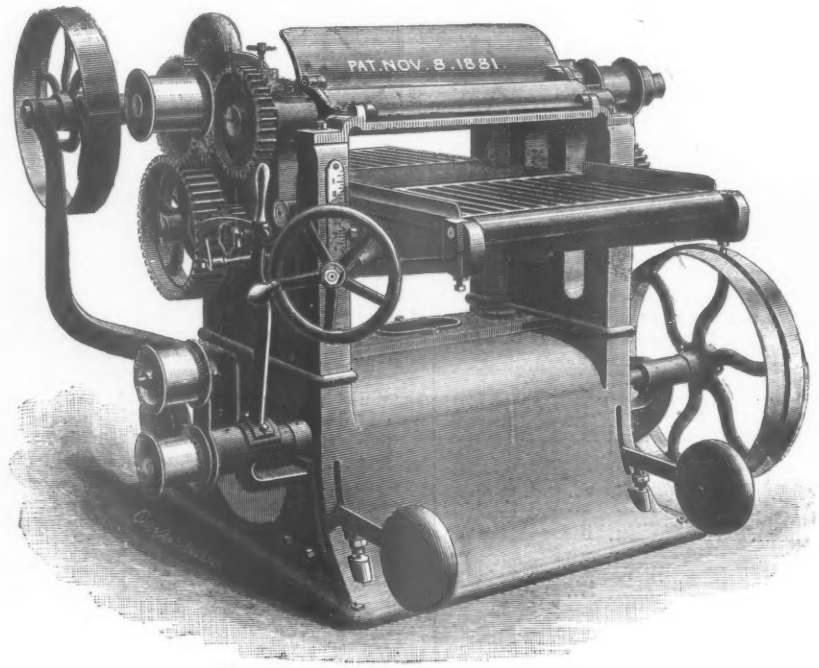
Improved Concord Planer.

This machine has been on the market many years, and is so well known that we give only a short description of its principal features in the improved form now made.

The frame, although of the same general appearance as in earlier machines, is now made with the base cast solid, the side pieces, carrying the cylinder and roll bearings, being securely bolted to it, so that the frame will not cramp or thrust the boxes out of line.

The bed is raised and lowered by means of a hand wheel in front of the machine, operating by a train of gears upon two steel screws 1¼ in. in diameter, with gun metal nuts 3 in. long. One revolution of the hand wheel changes the elevation of the bed one-sixteenth of an inch.

The feed rolls are so arranged that each is positively driven, but without the number of gears usually employed for the purpose, thus effecting a considerable saving in power.



IMPROVED CONCORD PLANER—24-IN. SIZE.

The cylinder is double belted and formed from a single piece of best forged steel with faces accurately planed and turned to 1⅛ in. at the journals. The knives are held in place by ¾-in. Norway iron bolts, the cutting edges describing a circle 5 in. in diameter. The cylinder bearings are 9 in. long, lined with babbitt and accurately fitted and tested. The chip breaker is so arranged that it cannot come in contact with the knives nor become wedged in taking the heaviest cut. The pressure bar is weighted, and thus made to yield slightly to inequalities of stock, so as to prevent "sticking."

All parts are made strictly to gauge and interchangeable, the number of the piece being cast or stamped upon it, facilitating repairs or renewal of wearing parts whenever necessary.

The weight of the machine is 2,200 lbs., and it will plane stock from ⅛-in. to 10 in. thick. It is made in widths of 20, 27 and 30 in., the two latter sizes taking stock up to 12 in. in thickness. It is made by the John A. White Co., of Dover, N. H.

Night Signaling—Past and Present.

BY ARTHUR H. JOHNSON,
Signal Engineer, N. Y. L. E. & W. R. R.

For many years after the introduction of fixed signals on railroads the lamps used for night signaling were very inferior, and many were the complaints made by those concerned. At that time the use of petroleum or kerosene oil for lamps was in its experimental stage, and a way of refining the oil so as to a great extent do away with its liability to explode had not been discovered. Animal oils and sperm candles were in universal use, and, as was afterwards shown, such oils will not compare with kerosene for illuminating purposes. The construction of the oil box, burner and lamp case, necessary to afford good breathing ports were not thoroughly understood. At length someone in America

discovered a process by which kerosene could be safely used in all households, and a huge market was at once found in England for this natural oil.

The constructors of railroad signal lamps had been looking forward to this development and at once set to work to construct suitable lamps to burn the new oil. By experimenting with this application, great progress was finally made in the details of lamp construction. So many lamps were required for the railways that signal lamp making became a separate industry, and great was the competition between the various concerns engaged in the business.

It early became apparent that the chief requirements were as follows: viz. (1). The free ingress and egress of air and gases, at the same time so guarding the flame by baffle plates as to prevent the light from being extinguished in stormy weather. The lamp must draw a good supply of air in still hot weather. (2). The oil box to be so constructed as to best keep the oil cool. (3). The burner to be constructed so as to direct the current of fresh air to the point of combustion. (4). The lens to be proportioned to the flame, and focused so as to throw nearly all the light equally distributed, and within the limits of the very acute angled cone. (5). The lamp case carrying the lens to be firmly fastened to the signal post, so that the centre line of the cone of light could be permanently fixed.

The form of lamp finally conceded by most of the roads to best meet the requirements answers to the following description: An outer cylindrical case, carrying a 6-in. plane-convex lens, and having a hinged top with snap fastening. The top carries a large hood and baffle plates for escape of gases. Air is admitted at the bottom by round holes. The outside case is firmly secured by means of a light cast-iron bracket to the signal post. Inside there is a square skeleton case, glazed all four sides, with door and a handle for carrying. The oil box is so constructed that the wick rests in an isolated chamber, which communicates with the main reservoir by small ducts. The cool air is made to pass completely through the middle of the oil box and reach the flame. There is a full description of this lamp in the *Railroad Gazette*, Oct. 24, 1890. This lamp was in general use in England, and in connection with the interlocking on the Continent, when the first Saxby & Farmer machine was erected in this country (at East Newark Junction), and I understand that the same form of lamp is in general use over there at the present time.

Instead of realizing that the night signals were at least equal in importance to the day signals, we directly departed from the result of years of experience as crystallized in the original lamps at East Newark and Perth Amboy Junctions, Pennsylvania Railroad, and have cast about for the cheapest possible signal lamps. With this end in view a small corrugated lens was adopted because it was cheap, and mounted in a small tin case.

A cheap oil box and burner were inserted in the case and the complete lamp placed on a hook, where it wobbles to this day. Thus at a single step we ignored the experience presented to us gratis, and went back to the barn yard lamp.

Presently came the old grumblings from enginemen and others concerned, about the indistinctness of the night signals and their liability to be mistaken for other lights and vice versa. The English roads, it will be remembered, silenced these complaints by improving the lamps and displaying powerful lights. Not knowing that in the main part this question had been thereby solved, several inventors hit upon a plan of illuminating the signal arm, so as to make a night semaphore signal, because, said they, "uniformity is what railroads require, therefore, why not make a night as well as a day semaphore." It seems to me that it would be just as logical to expect that because a plain red light is extremely arrestive as a signal by night, that such would be the case with a red disc of the same size by day. Setting aside the cost of illuminated blades, which are at least twice as expensive as those lamps at East Newark Junction, Dr. Jeffries and other eminent authorities have concluded that we have to principally rely on the intensity and distinct color of lights for good night signaling.

I do not wish it to be understood that I consider the English practice in night signaling approaches perfection, for I admit that in a few cases the back ground of city lights may be such as to be dangerous in case of the extinction of the signal light. But the obviation of this danger has never been seriously taken up in connection with the use of signal lamps. Would it not be well to convert the ordinary light into a flash light in such cases? I believe that several people have invented means for accomplishing this. If a white flash light and a still red light were used in all cases for main line signals, there would be no object in using green for "all clear," thus leaving us the unrestricted use of green for distant signals. I don't think that many people are aware that all the English distant signals show a red light in the danger position.

By the way, why has the horizontal position of the distant signal come to be termed the caution position, taking into consideration the fact that the distant is the most important signal whereby to stop a fast train? The distant in the horizontal position always used to be spoken of as at danger, and in that position it is most certainly a danger signal. Of course in our case where we are content, in many cases, to dispense with distant signals, even in block working, the use of red for distants might lead to serious mistakes.

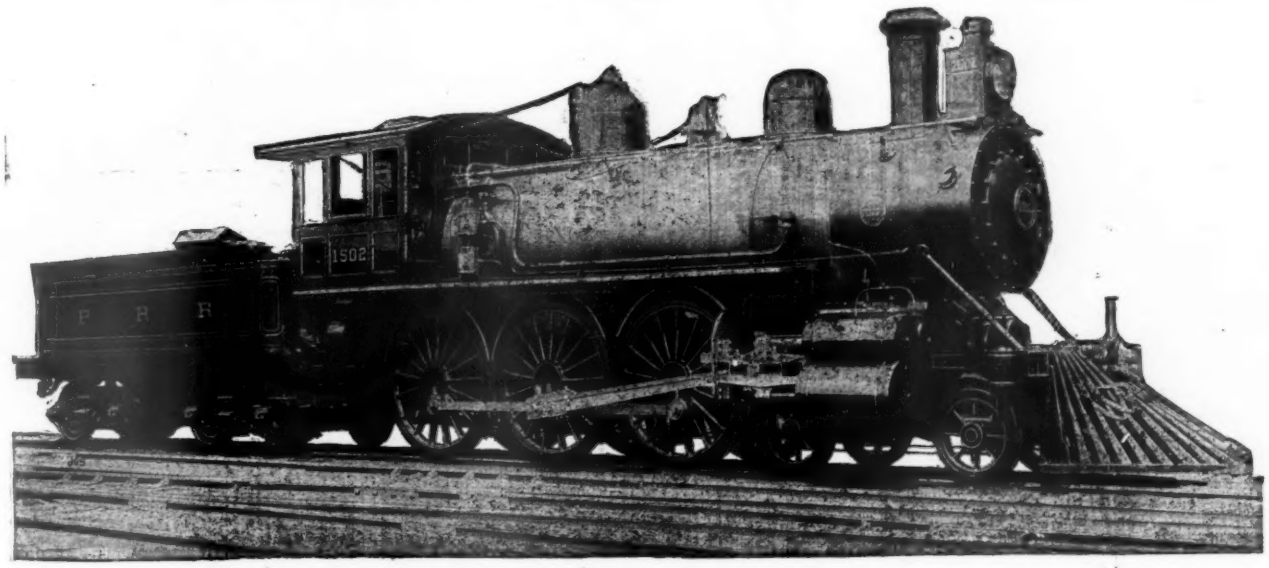
Then there is the peculiar idea that we should not expect an engineman to accept a clear signal which is on the same post as the red lights. Surely, considering that the white light simply signifies that there is permission to pass the signal post and proceed on a certain track the other red lights serve to emphasize which track is clear. The argument might, with equal propriety, be applied to day signals.

In conclusion, I may be permitted to suggest that criticism with regard to night signaling is almost worthless unless the critic has practically studied the matter in the locomotive cab of a fast night train.

Compound Passenger Locomotive for the Pennsylvania.

The engraving printed herewith shows a 10-wheel compound passenger locomotive recently built by the Baldwin Locomotive Works, of Philadelphia, for the Pennsylvania Railroad. We have already stated, in previous issues, that the Pennsylvania is to test in its fast train service a number of locomotives of various patterns from different builders. The engine which we now illustrate is practically a duplicate of that built at the same shops for the committee of the Master Mechanics' Association, which was described in the *Railroad Gazette* of Jan. 8 last. The principal dimensions of that engine are as follows:

Weight of engine in working order, 133,000 lbs.
Weight on driving wheels, 100,000 lbs.
Cylinders: high pressure, 14 × 24: low pressure, 24 × 24.
Driving wheels: 72 in. diameter, 66 in. centres.
Total wheel base, 24 ft. 2 in.; driving wheel-base, 12 ft. 6 in.
Straight-top boiler 62 in. diameter at smokebox end, with 270 2-in. tubes, 14 ft. long.
Firebox 120 in. long by 34 in. wide.
Working pressure, 180 lbs.
Grates, rocking, with drop.
Driving axle journals, 8 × 8½ in.
Truck wheels, 33¼ in. diameter, with wrought-iron spoke centres, and steel tires held by retaining rings.
Engine truck journals, 5 × 10 in.
Tender, 3,600 gallons capacity, fitted with water scoop.
Tender wheels 36 in. diameter.
Tender journal axles, 4 × 8 in.
Feed water supplied by two Sellers' 1877 No. 9½ injectors.
Westinghouse automatic brake on all driving and tender wheels, and Westinghouse train signals.
United States metallic packing for piston rods and valve stems.
Nathan sight feed lubricator.
Side rods with solid ends and bronze bushings.
Steam heating connections, Pennsylvania Railroad standard



COMPOUND PASSENGER LOCOMOTIVE—PENNSYLVANIA RAILROAD.

Built by the BALDWIN LOCOMOTIVE WORKS, *Philadelphia, Pa.*

Passenger Traffic of Boston Railroads.

A gain of over 4,000,000 passengers in one year may be regarded as a fair increase in business for the five railroad companies running trains out of Boston, while an addition of more than 3,000,000 to the number of people brought into and carried out of that city indicates a healthy growth in the suburban population. A careful study of the annual reports of the several railroad companies shows these figures for last year, and also brings out many interesting facts relative to the business of the roads. While there are actually eight separate and distinct standard gauge railroads entering Boston, each having its separate and distinct terminal facilities and stations, consolidations have resulted in leaving only five operating companies, and some people believe that within a few years one corporation will run all the roads on the north and another those on the south side of the city.

Although these five companies are known as Massachusetts corporations and their business is credited in that State, out of the 3,100 miles of railroad operated by them only a little over half, or 1,733, miles are located within the borders of the commonwealth, and although these five corporations operate 3,100 miles of railroad they own only a little more than one-half that number of miles. These facts are shown in the following table of miles of road:

Corporations.	Owned.	Operated.	Operated in Massachusetts.
Boston & Albany	305.60	388.73	332.10
Boston & Maine	315.70	1,210.03	472.48
Fitchburg	372.48	435.32	238.09
New York & New England	369.93	496.34	147.89
Old Colony	482.38	569.11	542.50
Totals	1,836.09	3,100.53	1,733.06

In the number of passengers carried during the year the Fitchburg road shows the largest per cent. of increase, though the smallest number of people transported.

The passenger statistics are summarized in the following table:

PASSENGER TRAFFIC.

Corporations.	No. passengers.	Passenger mileage.	Gain in passengers.
Boston & Albany	11,371,636	211,852,182	3.3 per ct. over 1890-1.
Boston & Maine	31,174,544	413,313,594	5.0 " " "
Fitchburg	6,795,423	106,427,328	10.0 " " "
N. Y. & N. Eng.	2,312,400	105,080,791	7.0 " " "
Old Colony	22,395,487	263,581,669	4.9 " " "
Totals	79,949,490	1,100,255,564	

The Boston & Albany and the Old Colony were the only roads that increased the average distance per passenger, the former gaining 0.35 of a mile, and the latter .07. The Boston & Maine lost .06 of a mile on each passenger, the Fitchburg .37 of a mile, and the New York & New England .62 of a mile.

This glance at the general passenger traffic of the standard guage roads radiating from Boston indicates the extent of the business, but the most interesting facts are found in a study of the statistics showing the amount of the traffic to and directly connected with that city. Although these roads traverse over 3,000 miles, more than three-fifths of the number of passengers transported are brought in or carried out of the city. But that does not show the actual movement of the business in and out of Boston. The little narrow gauge road, the Boston, Revere Beach & Lynn, is an important factor, for though only six miles long it came very near carrying as many passengers last year as either the New York & New England or the Fitchburg. In treating of the passenger business of Boston the B., R. B. & L. is to be considered. But even that does not show all the

traffic, for the West End Street Railway reaches stations on the Boston & Albany, on the Fitchburg, on the Boston & Maine, on the Old Colony, and on the New York & New England. It is impossible to give any reliable figures concerning the amount of the suburban business done by the West End road from these stations, but it is large, and the increasing use of electricity is making the company a still stronger competitor with the steam roads.

Taking the six steam roads then, it is found that during twelve months they brought into Boston 25,612,001 passengers, and 25,682,797 were carried out. In other words, 51,294,798 people were taken in and out of Boston in one year, or an average of 140,534 every day. This was a gain of over 8,800 per day, or 3,222,322 for the 365 days. Of the six companies the Boston & Maine was far ahead in the number of passengers, and the Old Colony came next. But the Boston & Maine really consists of three separate roads, each having its terminal station, namely, the Boston & Maine, the Eastern and the Boston & Lowell, and each of these roads does a large suburban business. The Old Colony consists of two separate roads, each with its terminal station—the Old Colony and the Boston & Providence. Averaging the Boston & Maine's figures, it will be seen that each of its roads carried 7,005,357 passengers, and serving the Old Colony the same way its two roads averaged 6,511,893 passengers. The Boston & Albany thus appears to have done the largest business of any single road, its figures showing 7,024,170 passengers.

A comparison of the increase of the general and the Boston business of the several roads is interesting. The Fitchburg road made the largest per cent. of gain in both branches, but while it gained 10 per cent. on all passenger business it increased 11.62 per cent. on its Boston traffic. The New York & New England road also made a larger per cent. of gain on Boston business than on all its traffic; the record shows that while on the latter its increase was 7 per cent., on the former it was 9.32 per cent. The Boston & Maine had 6.72 per cent. more Boston business than the previous year, while on all its business the gain was only 5 per cent. The Boston & Albany also made its largest increase on Boston traffic, 5.82 per cent., while on all business it was only 3.3 per cent. For some reason the Old Colony road stands alone in showing a less relative gain on Boston traffic than on its entire business. While it increased 4.9 per cent. on its whole passenger traffic its increase on Boston business was only 3.82 per cent. It is possible that the putting on of electric cars by the West End road in competition with the Old Colony at a number of stations may have reduced the suburban traffic. The Revere Beach road gained 4.8 per cent. on its traffic over the previous year.

The number of passengers carried by all the roads was very evenly divided between inward and outward bound. The number to Boston was 25,612,001, and the number out of the city was 25,682,797, showing a difference of only 70,796, or about 194 per day for all the roads. The following tabular statement presents the figures of Boston traffic in a form for easy comparison:

Companies.	To Boston.	From Boston.	Total.	Increase over 1890.	
				No	%
Boston & Albany...	3,502,585	3,521,585	7,024,170	409,019	5.82
Boston & Maine....	10,543,954	10,472,116	21,016,070	1,414,053	6.72
Fitchburg.....	1,976,321	2,017,336	3,993,657	461,128	11.62
N. Y. & New Eng	1,736,398	1,716,917	3,453,315	321,707	9.32
Old Colony.....	6,470,706	6,553,080	13,023,786	479,842	3.82
Boston, Revere Beach & Lynn....	1,382,037	1,401,761	2,783,798	133,571	4.80
Totals.....	25,612,001	25,682,797	51,294,798	3,222,320	.....

Western Railway Club—May Meeting.

The regular monthly meeting of the Western Railway Club was held in its rooms, Rookery Building, on May 17. Mr. W. H. Lewis read a paper on "The Design and Correct Proportions for Locomotive Smokestacks and Exhaust Nozzles."

Mr. Lewis began by quoting from a report of the Master Mechanics' Association as follows: "The committee has had considerable experience with both straight and taper stacks, and is of the opinion that the stack with the double taper is decidedly the best, and that the size of the stack has a very marked effect upon the steaming, with any given nozzle. Reduction of stack diameters will generally permit of increase in nozzle diameters. . . . The reduction of the stack near its base with a double taper is not a mere theory, but is a recognized scientific principle known as the contracted vein. . . ."

While considering this principle is occurred to me that the same form might be used in the exhaust pipe, carrying out the full lines as laid down in Trautwine [Fig. 10, page 260, edition of 1887.—EDITOR], as shown in the accompanying sketch, No. 1, the top of the pipe being on a line with the base of the stack. This, however, defeated all that we had gained by improving the shape of the stack for it prevented a proper combination of the gases with the exhaust at the line of contraction. I reduced the height gradually, as shown by lines *A*, *B*, *C*, *D*, . . . and while I have not yet succeeded in establishing the correct relations between the top of the pipe and the stack, I still think the principle correct, and that its use will result in a decrease of back pressure in the cylinders as well as a milder draft, which will lead to full economy. The developments in connection with the compound locomotive have demonstrated that steam can be maintained with a milder draft than is usually employed in a simple engine, and a large share of the fuel economy effected in compound locomotives is due, I believe, to this cause. . . . With an exhaust pipe as shown in Fig. 2, in which the bridge approaches within 8 in. of the nozzle, the effect was to send the steam from side to side, and in three months I found each side of the stack base cut out to a depth of ¼ in. in the form of an ellipse which was 8 in. long and 4 in. wide. . . . The column of steam continues on in the same angle at which it approaches the exhaust tip. This points to the necessity of a low bridge that will allow the column to straighten before it reaches the nozzle. The momentum of the exhaust will insure its upward tendency, with a very slight bridge at the base of the exhaust pipe. The possible improvements in this direction are increased economy in fuel consumption and increased power of the engine by the removal of back pressure in the cylinders. . . .

In an informal discussion of this paper, Mr. J. N. Barr, of the Chicago, Milwaukee & St. Paul, said that he once made quite a number of experiments on exhaust

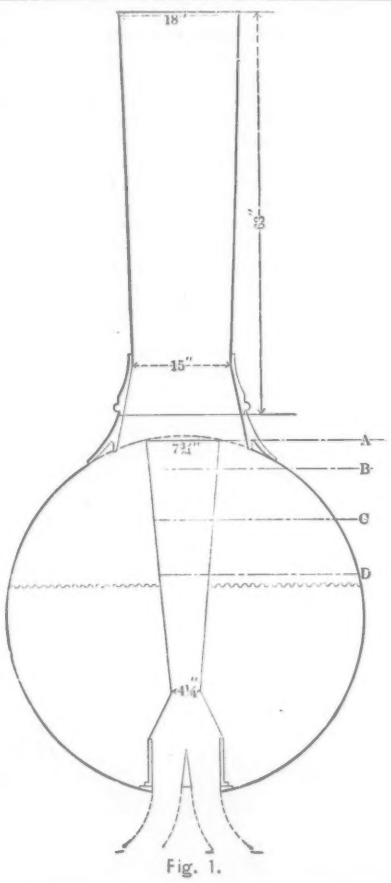


Fig. 1.

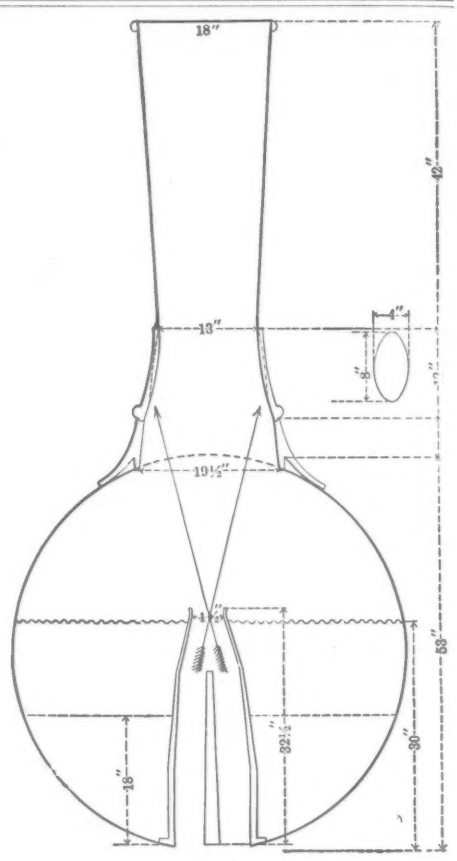


Fig. 2.

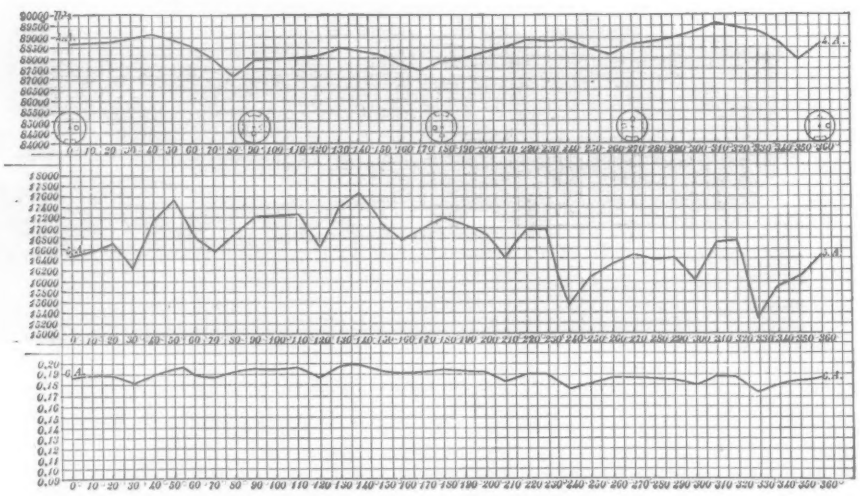


Fig. 1—Data for 10 miles an hour.

Data applicable to ten-wheel locomotive with 60¼-in. drivers and 19 × 26-in. cylinders.

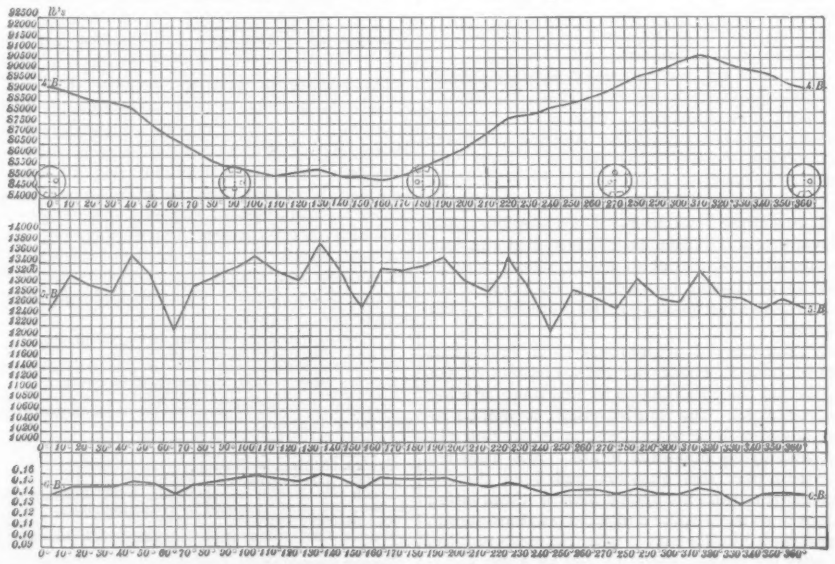


Fig. 2—Data for 20 miles an hour.

IRREGULAR WEAR OF DRIVING WHEEL TIRES.

pipes and nozzles, "and when I got through I was satisfied that I knew less than when I began."

The subject of coach cleaning was discussed by Mr. Barr, Mr. Lewis, Mr. Files and Mr. Townsend. The general view of those present was that soap and water was the best substance for cleaning coaches. The Chicago & Alton uses a weak solution of oxalic acid and finds it quite efficient.

Mr. E. M. Herr, formerly Master Mechanic of the Chicago, Milwaukee & St. Paul, and now Superintendent of the Grant Locomotive Works, read the following paper on

IRREGULAR WEAR OF LOCOMOTIVE DRIVING-WHEEL TIRES.

At the February meeting of this club in 1881, Mr. J. N. Barr read a paper on this subject, giving data in regard to a particular case of irregular tire wear. Shortly after this time the writer arranged to systematically measure the irregularities of tire wear of all locomotive driving-wheels passing through the principal shop of the C., M. & St. P. at Milwaukee. In addition to making these measurements the weight of counterbalance in the wheels was taken and all rods and reciprocating parts were also weighed. The engines passing through this shop include eight-wheel freight and passenger engines, switch engines and ten-wheel freight engines. The latter only will be considered in this paper. The following are the principal dimensions and weights necessary to determine the rotative force and pressure of each wheel on rail at various speeds and all positions of crank.

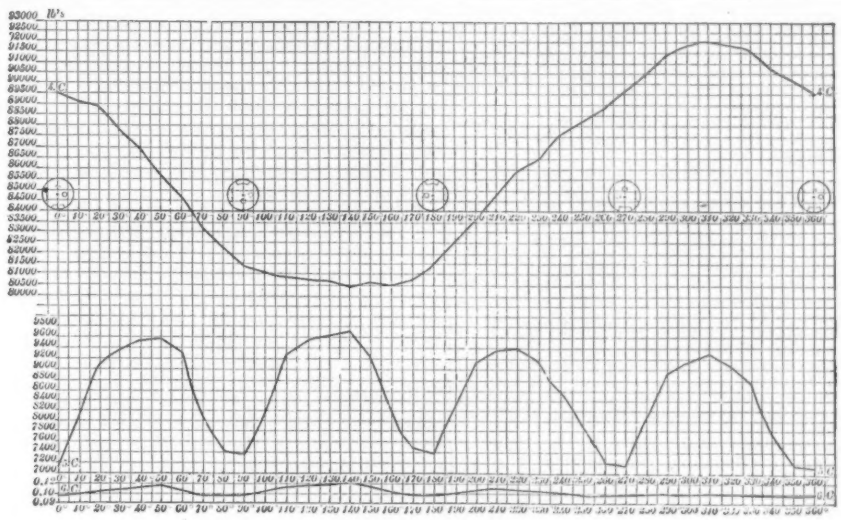


Fig. 3—Data for 30 miles an hour.

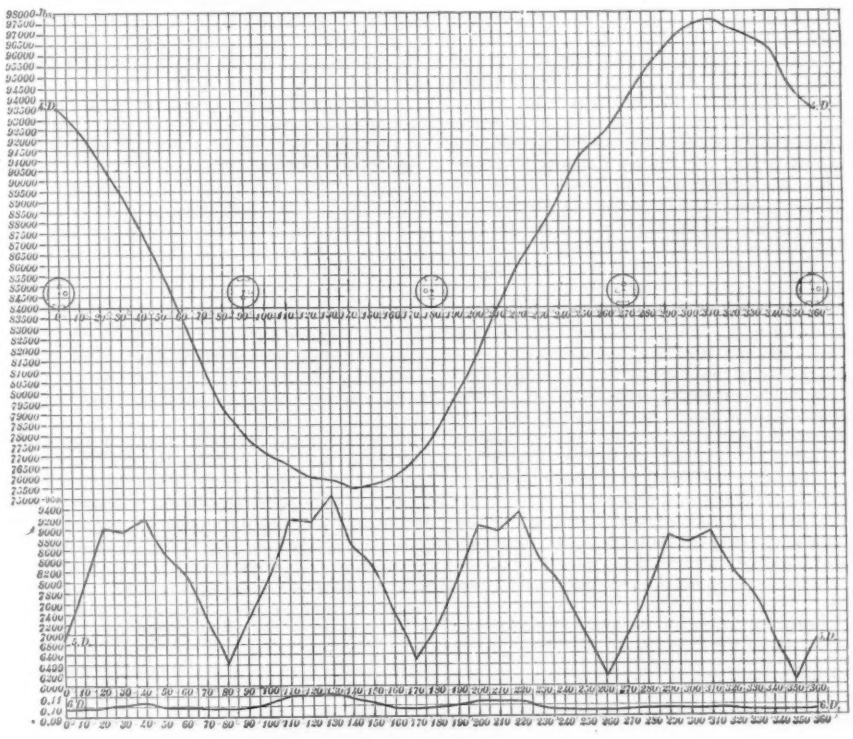


Fig. 4—Data for 40 miles an hour.

The tires of 53 of this class of engine were measured. Unfortunately they were not all counterbalanced alike, but all agreed in having the forward and back wheels overbalanced, and the middle or main wheels underbalanced statically in 70 per cent. of the engines, and in all cases underbalanced according to the rule now followed on the C. M. & St. P., of adding to the weight necessary to balance the revolving weights two-thirds of the weight of the reciprocating parts, divided equally between the wheels. The weights of overbalance in forward and back wheels and underbalance in main wheel average as follows:

Front wheel, actual average overbalance, weighed at crank-pin, 271 lbs.
Main wheel, actual average underbalance, weighed at crank-pin, 80 lbs.
Back wheel, actual average overbalance, weighed at crank-pin, 237 lbs.

The following formulæ have been used in determining the forces in action:

Cylinders, 19 in. diameter.
Stroke, 26 in.
Drivers, new tire, 62 in.; taken here at 60½ in.
Length of main rod, 10 ft.
Diameter of piston rod, 3¼ in.
Total weight of drivers, 84,000 lbs., distributed equally.
Weight of reciprocating parts, viz., piston, piston rod, crosshead and forward end of main rod, 729 lbs.
Steam pressure, 150 lbs.
Weight of back end of main rod taken as a revolving weight.

Notation.

P Pressure of each wheel on rail.
W Weight of each wheel on rail, engine at rest.
C Centrifugal force of overbalance.
R Rotative force at rail from one cylinder.
A Acceleration of reciprocating parts.
p Resultant pressure against piston.
S Length of stroke.
n Ratio of length of main rod to length of crank.
d Diameter of drivers.
d Angle of crank with horizontal.
B Angle of main rod with horizontal.

Hence—

$$P = W + C \sin a + \frac{(p + A)}{\sqrt{\frac{n^2}{\sin^2 d} - 1}}$$

$$R = (p + A)\left(\sin d - \frac{\cos d}{\sqrt{\frac{n^2}{\sin^2 a} - 1}} \right) \frac{S}{D}$$

The point 0° is taken, in all tables and diagrams hat follow, at the point of contact between tire and rail of wheels on right side of engine, with the right crank on the forward centre, positive rotation being that produced by running the engine forward. The values "*P*" and "*R*" have been calculated for every 10 degrees of revolution of each wheel at four speeds, 10, 20, 30 and 40 miles per hour. The pressures upon the piston used in these calculations were obtained from actual indicator cards taken at these speeds, and with a point of cut-off found by the examination of a large number of cards to be the usual point at which engine is worked in freight service at the speed taken. The points of cut-off used are: At 10 miles an hour, 13 in.; 20 miles an hour, 11 in.; 30 miles an hour, 8 in., and 40 miles an hour, 6 in.

The results of these calculations for each of the wheels on the right side of the engine are shown in the diagrams, Figs. 1, 2, 3, 4 and 5. For the left wheels the figures are the same, but the corresponding points are one-quarter of a revolution back of those on right wheel, on account of the right crank leading one-quarter. The total weight of all drivers on rail, the total rotative force at rail and the coefficient of slip are shown in diagrams 1, 2, 3 and 4. The coefficient of slip is obtained by dividing the total rotative force at the rail by the total weight on rail. When this coefficient of slip equals the coefficient of friction between tire and rail, the engine is at the point of slipping; therefore, the maximum values of the coefficient of slip indicate the points where the engine is most likely to slip the drivers.

Diagram No. 1 is for a speed of 10 miles an hour; No. 2, 20 miles an hour; No. 3, 30 miles an hour, and No. 4, 40 miles an hour.

An inspection of curves 4A, 4B, 4C and 4D shows the wide variation in the total pressure on rail at speeds no higher than 40 miles an hour with an engine counterbalanced much better than many in regular service. The variation in the weight on the rail in the forward and back wheels is, of course, due entirely to the centrifugal force of the overbalance and amounts, at 40 miles an hour, to a difference in total pressure on the rail of over 20,000 lbs. As this varies with the square of the speed, the importance of keeping the overbalance as low as possible is evident. This means reducing the weight of the reciprocating parts to the minimum, and adding to the counterbalance necessary to balance the revolving parts as small a part of the weight of the reciprocating parts as is consistent with a good riding and smooth working engine.

Curves 4A and 4B in diagrams 1 and 2 show the total weight on drivers to be always greater than the actual weight of engine. This, at first sight, looks anomalous, but is due to the angularity of the main rod always causing an increase of pressure on the main wheel. There is, of course, a corresponding upward pressure on the guides, reducing the weight on the truck.

Curves 5A, 5B, 5C and 5D, show the variation in the

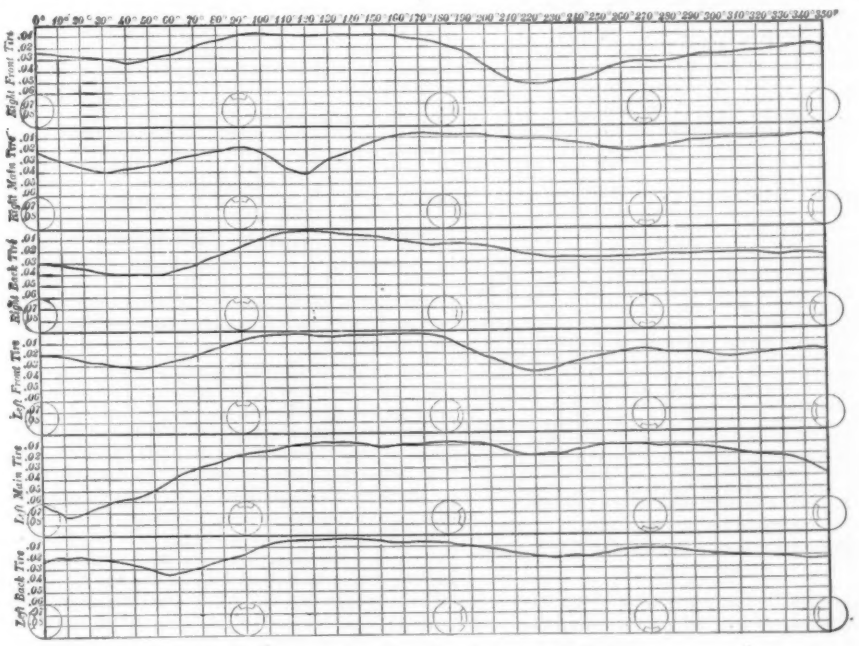


Fig. 5—Irregular Wear of Driving Wheel Tires.

Averages of data from 53 ten-wheel locomotives.

rotative or tractive force of the engine at various speeds and different points of cut-off. These indicate that this engine would pull more steadily at about a speed of 20 miles an hour than at either higher or lower speeds. The rotative force is, of course, affected by changes in the cut-off, but at high speeds the inertia of the reciprocating parts becomes the more important and materially affects the steadiness of the engine, regardless of the amount of steam worked. This is readily seen in any engine by an inspection of the diagram of a dynamom-

eter car taken at high speed. Curves 6A, 6B, 6C and 6D give the ratio of the rotative force to weight on rail, which I have followed Mr. Barr in calling the coefficient of slip. The maximum values here follow quite closely the maximum of the curve of rotative force, and it has its maximum value, for all speeds shown, between 130 degrees and 140 degrees.

Diagram 5 shows the average irregular wear of each of the driving wheel tires of 53 ten-wheel freight engines, obtained as follows:

Each pair of tires when placed in the lathe was rotated and the highest point of worn tread found. A bar of steel with end cut off square placed in the tool rest is brought against the highest spot and securely clamped. The wheel is then rotated, if necessary, to bring the 0 degree point opposite the end of this bar. The depth of wear below the highest point is then measured in hundredths of an inch by inserting as many metal strips, each exactly $\frac{1}{100}$-in. thick, between bar end and tire as the space will admit. Similar measurements every 10 degrees around the wheel are made. An average of measurements so made for 53 engines is platted on diagram 5, each tire being considered developed on the datum line and the amount of wear in hundredths of inches platted therefrom. The diagrams of wheels on this sheet show clearly the position of each tire on its wheel.

We will consider first front and back tires only, as these wheels were overbalanced, the main wheels being underbalanced. An inspection of the diagram shows quite uniformly in both tires, two locations of maximum wear, one beginning at about 160 deg. and attaining its maximum at 220 deg. or 230 deg., the other becoming pronounced at about 10 deg. or 20 deg. and attaining its maximum at about 50 deg. It will also be noted that both of these low spots are connected from 220 deg. to 50 deg. in the direction of rotation by a portion of the tire much more worn than that portion from 50 deg. to 220 deg. In explaining the cause of this irregular wear it is necessary to bear in mind that there are two ways in which driving wheels are slipped. First, when the slipping is slight but distinctly noticeable, extending through but a small portion of a revolution; and, second, when the hold on the rail is entirely broken and the wheels slip through a number of revolutions, usually turning with considerable velocity. There may a third in which the wheels slip imperceptibly, but of this I have seen no satisfactory proof, but, on the contrary, considerable evidence that it does not exist.

Let us consider the first case, when slipping is slight. This occurs almost without exception on heavy pulls at slow speed, being often seen when the engine is pulling hard on a hill, with the engineer trying to use sand sparingly, but alert "to catch her" at the first indication of "letting go." The beginning of slip must occur under these conditions at or near a maximum of the coefficient of slip. Referring to diagrams 1 and 2 we find a maximum value of the coefficient of slip a 50 deg. and 140 deg. at 10 miles per hour, and at 40 deg. and 160 deg. at 20 miles per hour. A slight slip here would cause a spot to wear following these points which the diagram shows. It is also noticeable that the amount of wear following 160 deg. is much greater than that following 40 deg. In the former case the weight on rail is rapidly increasing, in the latter diminishing.

The effects of the second case of slipping are shown by the long worn spot, connecting the spots last considered. When the slipping occurs at speed, or the wheels let go and spin with considerable velocity, the variation of weight upon the rail should cause the greatest wear in that portion of the tire under greatest pressure. At 30 and 40 miles an hour the pressure on the rail from 160 deg. to 30 deg. varies from 12,000 to nearly 19,000 lbs., while from 30 deg. to 160 deg. it never exceeds 13,000 lbs., and falls at 90 deg. to 100 deg. to nearly 9,000 lbs. The latter point is the least worn part of the tire.

As of course both wheels must slip together, the question may be asked, are there corresponding spots to these on the left tires one quarter back? Now, 90 deg. back of 40 deg. is 310 deg., and on the left, front and back wheels at this point can be seen a slight spot. It is nearly worn out or merged into the long spot through this point, due to slipping at speed. Then, again, 90 deg. back of 140 deg. is 50 deg., and here a decided spot is found on both left, front and back wheels.

With the main wheels the reasoning is the same, but as these wheels are underbalanced, the conditions are quite different from those found for front and back wheels. The spots caused by slight slipping near 40 deg. and 140 deg. should be found in these wheels as in the others, unless the accompanying condition of necessary pressure is absent. We find from 16,000 to 17,000 lbs. at the former point, and from 14,000 to 15,500 at the latter. This is an ample pressure to produce abrasion, and an examination of diagram 5 shows decided spots near 40 deg., and lighter ones near 140 deg. Again, the pressure is found to be greatest in these wheels between 10 deg. and 120 deg., where quite a decided spot is found. The wear of the tire on this pair of wheels is also modified by the pressure on the rail due to the angularity of the main rod, which attains the maximum at 90 deg. and 270

appliances for freight trains, and the record that has been made demonstrates that legislation either State or National would tend more to retard than to accelerate this movement." The President also referred to the probability of the Fox solid pressed steel truck demanding considerable attention during the coming year, and called attention to the necessity for an exceedingly careful consideration of the several clauses in the rules of interchange pertaining to the repairs to foreign cars chargeable to the owners.

The Secretary's report was then read. It showed that the total membership in October, 1891, was as follows: Active, 163; representive, 114; associate, 7; total, 284; since then six railroad companies have appointed representatives and resignations and deaths of members have changed the number so that the membership is now as follows: Active, 171; representative, 120; associate, 7; total, 298. The cars represented by the Association at the present time number 1,071,219, of which there are 11,570 not heretofore represented. The total increase of old and new roads in car representation is, as compiled from the latest returns, 79,655. The cash collected by the Secretary since the last report and up to June 14 was $7,191.79. The disbursements during the same period were $7,191.79, there being now no funds in the hands of the Secretary. The Association has no debts except some small bills for printing the reports for the present convention. The arrears of unpaid dues are $380.

The Treasurer reported a balance in the treasury to date of $4,841.07.

The dues for the coming year were fixed at $5 a vote. The President appointed the following committee for nominating officers for the ensuing year: F. D. Adams, J. M. Wallace, C. A. Smith, E. D. Bronner, R. D. Waitt; also he appointed as the Committee on Subjects for the ensuing year to report on Friday morning: Joseph Townsend, M. M. Martin, Pulaski Leeds and E. B. Wall, and as the Committee on Correspondence and Resolutions: R. H. Soule and W. H. Day; also an obituary committee on the death of E. E. Gore, John Voorhees and A. R. McAlpine; and on the death of Mr. William Turreff, William Garstang and John S. Lentz, and on the death of Mr. Ross Kells, John Mackenzie and F. B. Griffith. E. D. Nelson, C. A. Schroyer and Robert Walker were elected the Auditing Committee.

The Secretary then gave an account of the work of the Executive Committee pertaining to the Standard Coupler Gauges, and exhibited a gauge made according to the standard contour, a description of which and an illustration has been given in these columns before. The Secretary read a letter from the Pratt & Whitney Company, the makers of the standard gauge, stating that 50 gauges had been made and 32 delivered, and there are 13 now fully complete and ready for delivery. The Secretary then read the following letter from the Secretary of the Inter-State Commerce Commission, dated Washington, June 13, 1892:

To the Secretary of Master Car Builders' Association:

DEAR SIR: Yours of the 8th inst., in which you invite the Commission to be represented at your convention to be held at Saratoga Springs, N. Y., commencing on the 15th inst., has been received. The Commission appreciates the courtesy of this invitation and recognizes fully the importance of your Association, and the valuable results which have followed upon the discussion and the action taken from time to time in your annual conventions. The Commission is particularly impressed with the great value of your association in the line of perfecting and introducing into general and uniform use, so far as possible, those devices and appliances intended for the protection and for the security of human life and limb, especially the lives and limbs of railroad employés, now constituting so large a class, and among whom casualties have unhappily been so frequent.

It is with much regret, therefore, that I have to state to you that the Commission, owing to official engagements that cannot be deferred without putting complainants and others to great inconvenience and expense, will be unable on this occasion to attend your convention. Your work has, however, the warmest sympathy of the Commission, and I am sure will, so far as in its power lies, receive its cordial support and co-operation.

EDWARD A. MOSELEY,
Secretary.

changed to 6 in." Mr. J. N. Barr (C. M. & St. P.) indorsed this resolution. Mr. T. R. Bissell (Wagner Palace Car Company) was of the opinion that more cars would be found in service with 10 in. piston travels than with anything less. Mr. C. A. Schroyer (C. & N. W.) asked for 3 in. variation between the maximum and the minimum, thus making the minimum 6 in. and the maximum 9 in. Mr. J. W. Marden (Fitchburg) agreed with Mr. Schroyer.

Mr. R. H. Soule (Norfolk & Western) offered the following amendments to Mr. Rhodes' resolution: "That wherever mention is made in this report fixing the maximum or the minimum piston travel on air brakes, that it be changed to read that the minimum shall be 6 in. and the maximum travel 8 in." The amendment was accepted by Mr. Rhodes.

Mr. A. M. Waitt (L. S. & M. S.) called attention to the wide variation of the piston travel on cars having the brake beams hung above the truck springs, which variation was found frequently to be as much as 2 in. between loaded and unloaded cars, therefore it was his opinion that the recommendation of the committee namely, 4 in. as a minimum and 8 in. as a maximum, should be adopted in preference to limits giving a less variation.

Mr. Soule's amendment to Mr. Rhodes' resolution was finally carried after some discussion about details by various members and several explanations by the Committee and others of what was meant by the report of the Committee, by a vote of 32 to 28.

A resolution was made by Mr. Waitt, modified by Mr. Casanave and seconded by Mr. Leeds, to refer back to the Committee the paragraph in the report relating to the test for train pipe leakage on page 6 to be reported upon again at the Friday morning session.

Mr. Waitt called attention to the instructions on pages 9 and 10 calling for an examination of the brakes before starting down heavy grades, asking if it was intended that these instructions should be carried out. Mr. E. B. Wall moved that the words "before starting down heavy grades" be expunged from the instructions. This motion was seconded by Mr. Casanave. Mr. Pulaski Leeds then said: "I think that sentence should be left in. We have a grade of 217 ft. in a mile, and I think everybody after once coming down that hill would be for leaving this clause in. We have to use every brake we have and reverse the engine besides to get down the hill."

Mr. Waitt then explained that on the Lake Shore road there is a rule in force requiring an engineer to test the brakes on the entire train by applying them at least one mile before reaching a heavy down grade, which rule he thought would fill all requirements of inspection before going down heavy grades. He moved that a clause embodying such a rule be inserted in the instructions as amended by Mr. Wall's motion.

Mr. Roberts (Chicago & Grand Trunk) called attention to the fact that the instructions referred to "heavy grades," which was a term giving sufficient latitude to the instructions. If the grades were comparatively light, then the instructions did not have to be carried out, and if the grades were very heavy, then special instructions could be issued by any railroad company emphasizing the instructions printed in the report. The motion was then put with the result of a tie vote. The President then cast the decisive vote affirming Mr. Wall's resolution.

The Secretary, Mr. John W. Cloud, then made the following remarks, after which the vote was reconsidered, on motion of Mr. Waitt, seconded by Mr. Wall. After the Secretary's remarks the question was referred to the committee, to be reported upon for final action on Friday morning.

Mr. John W. Cloud's remarks.—I believe there is a misapprehension in this matter on the part of certain members and that the change which has just been decided upon has been under a misunderstanding. It is the practice on all heavy grade roads, where it is almost im- [illegible]

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the upper edge placed perfectly horizontal and about 2 in. below the position that the lower chord of the permanent bridge will occupy. Place two lines of horizontal braces of about 3 × 12-in. plank about 4 ft. below the top of the caps, on the outsides of the centre posts and parallel to the axis of the bridge; these will act both as bracing and scaffolding for the carpenters. Then saw off the tops of the posts flush with the top of the guide plank; place the cap (which should be 22 ft. long in order to use it as false work in raising the permanent bridge) on top of the posts and drift bolt it to them with bolts of ⅝ or ¾ in. diameter and 22 in. long, and block up on top of the caps to the proper height for stringers. When the first bent is raised and properly braced, move the "guide boat" and lever arms forward, using the first bent in the same manner as the abutment was used in the start and so on until the forces working in the same way from the other end of the span are met.

14th. Block up on on the caps to the proper height and put stringers, cross-ties and rails in place.

15th. The above description is for cases where the height is not too great for a single deck trestle. Where additional height is required, while part of the carpenter force is raising the first deck others should frame the second deck, having determined its height by deciding to what height the first deck will be built.

16th. In cases where there is little or no water the above described method may be used for clearing the wreck, but raising the trestle is simplified by framing bents to the proper height and raising them by use of ropes attached to a locomotive.

An engineer should take charge of the work himself, and it should be understood that there is but one man in charge. He should see that his forces never have to wait for materials after the work has been started. These notes are suggestive in case of an emergency and when an engineer is poorly prepared to meet it. A memorandum is given below of such things as every company should have at a convenient position on its line, and which, in the above described contingencies, will make the task much easier. [We omit this list.]

Tests of Illinois Central Suburban Locomotive.

Mr. Henry Schlacks, Superintendent of Machinery of the Illinois Central road, has been making some investigations into the various means of reducing the smoke nuisance. The pressure brought to bear upon the Illinois Central by the citizens of Chicago is very great; the road runs along a thickly settled part of the city, containing many beautiful residences, and the locomotives burn bituminous coal and make large quantities of smoke. Among other investigations made by Mr. Schlacks is one about engines using anthracite pea coal instead of bituminous coal. The Philadelphia & Reading Coal & Iron Co., desiring to increase the market in Chicago for anthracite coal, has constructed a suburban locomotive with a Wootten boiler and Vauclain compound cylinders from joint designs of Mr. L. B. Paxson, Superintendent of Motive Power of the Philadelphia & Reading road and the Baldwin Locomotive Works. Several of the engines were first run and are now running on the Reading road, where they are successfully hauling heavy suburban trains. The tests on the Illinois Central were made by an engineer of tests from the Chicago office of Mr. D. L. Barnes, of the *Railroad Gazette*. The description of the engine tested and the results of the tests are given in what follows:

The locomotives tested were: (*A*) Vauclain compound Wootten suburban, No. 623, built by the Baldwin Loco-

[illegible] ance made in calculations.

Coal Measurements.—The coal measurements were made by weighing into sacks holding 200 lbs. and emptying into the tender nearly enough for the run to be made, and piling enough on in bags to complete the run. In order that no coal should be charged to the engine until starting, enough coal was placed in the cab separate from that to be used upon the run to keep the fire up until starting, when the condition of the fire was noted. Coal was then taken from the tender, and at the end of the run the fire brought to the same condition as nearly as was possible. This was necessarily a matter of judgment, and somewhat unsatisfactory in the case of compound engine No. 623, owing to the character of the fire, which at starting was usually thinly and evenly spread over the grate, while after a run of 40 or 50 miles the grate was covered with a bed of ashes and clinkers on top of which lay a bed of fire of varying thickness. These conditions, together with the large area of grate, combined to render the coal measurements somewhat inaccurate. The error from this cause was probably not over 300 lbs., though this amount on a run to Harvey and return would mean an error of about 5 per cent., as shown by the fuel account. It is, however, difficult to see how a more accurate measurement could be made by any other method.

Pyrometer.—A 900 degree pyrometer was placed in the smokebox just in front of the netting, and about 8 ins. away from the tube sheet, with the dial in such position that the man at the indicator could note variations in smoke-box temperature.

Vacuum Gauge.—The vacuum gauge consisted of a U-shaped glass tube partly filled with water, with a sliding scale, upon which the differences in height of the two water columns could be read directly. The upper end of one tube was left open and the other connected with the smokebox opposite the nozzle by ⅜ in. rubber tubing.

Indicator.—A Tabor indicator was used in all the tests, and motion for the drum taken from the crosshead by a pantagraph made for the purpose and connected to running board.

Calorimeter.—The calorimeter was of the type first used on the test of the Baldwin 10-wheeler upon the Baltimore & Ohio railroad in May, 1891, and described in the *Railroad Gazette*, Nov. 27, 1891. This is a simple instrument and very sensitive, as the bulb of the thermometer is exposed to the steam so that any variation of pressure or change in the quality of the steam is almost instantly shown. It was placed in the dome opposite the throttle valve, as it was believed that in this position only would it receive steam in the condition in which it leaves the boiler and unaffected by any possible condensation or superheating in the steam pipe.

Speed Recorders.—Two Boyer speed recorders were used: one a standard machine running ½ in. of paper per mile, which was used on freight and passenger runs; the other a machine made especially for suburban work running 12 in. per mile. Both recorders were satisfactory, but the second one was found to be of especial value in suburban work, showing as it did the manner in which the train was accelerated, as well as more ac-

runs was begun on April 8 with this engine to [illegible] determine the most favorable conditions of operation and allow those in charge to become accustomed to the working and firing of the engine. Trials were made of hard coal, soft coal and a mixture of hard and soft, and trains of from four to sixteen cars were hauled. The final runs were made on April 23, 26 and 27, with train No. 31 to Harvey and No. 63 back to Chicago. The safety valve was set to blow off at about 195 lbs. pressure.

Date	23	26	27
Left Chicago	10:40	10:45	10:40
Delays	7 min.	4 min.	6 min.
Arrived at Harvey	11:43	11:42½	11:43
Left Harvey	11:51	11:51	11:51
Delays	[illegible]	......	......
Arrived at Chicago	1:03	1:00	1:05
Average steam pressure	168	183	186
Average temperature	60°	40°	48°
Direction of wind	West	Northeast	East
Weather	Cloudy	Cloudy	Cloudy
Condition of rail	Dry	Dry	Dry
Feed water temperature	49°	51°	50°
Number of cars	15	14	15
Coal used, pounds	5,025	5,043	4,930
Water used, "	22,924	22,781	23,367
Miles run	39.24	39.74	39.24
Car miles	588.6	549.4	588.6
Ton miles, train	9784.5	9165.8	9781.6
Total ton miles	12,894	12,297	12,894
Actual evaporation	4.56	4.51	4.79
Equivalent evaporation	5.62	5.56	5.93
Coal used per mile, lbs	128	126.4	124.5
Water used per mile, lbs	583.68	569.27	641.0
Coal per car mile, lbs	8.53	9.11	8.37
Water per car mile, lbs	38.91	41.45	40.16
Coal per 100 ton miles, train lbs	51.35	54.97	50.58
Water per 100 ton miles, train lbs	234.16	248.46	241.32
Coal per 100 ton miles, total lbs	38.90	41.00	38.16
Water per 100 ton miles, total lbs	177.38	185.32	182.50

With anthracite pea and bituminous coal, mixed half and half, the engine smoked quite badly, especially on heavy trains, when firing was frequent and heavy. On light trains the smoke could be controlled to a considerable extent by the blower. The engine was laid up on April 10, and the front of the grate bricked over about 3 ft. back. The first trip on April 11 was made with this arrangement. No great difference in the smoking of the engine was noticed, though the change seemed to slightly lessen the smoke.

On April 11 two runs were made with bituminous pea coal. The first, a train of 15 cars to Harvey, hauling one Pullman sleeper to Kensington, and the second a regular train of five cars to Homewood. On the first trip the engine left Central Depot with a clear fire and making little or no smoke. A few shovels of coal at Van Buren street resulted in a dense cloud of smoke, which had quite perceptibly abated at Twelfth street. Firing was invariably followed by heavy smoke, upon which neither the exhaust nor blower had any effect for some time. With lighter trains the smoke was lessened, though still quite noticeable. It is but fair to state that this boiler was not expected to burn soft coal with the grate then in use, and that the brick with which a part of the grate was covered was put in, not with a view of preventing smoke entirely, but with a hope of abating it.

* This engine was described in the *Railroad Gazette*, April 1, 1892.

Fig. 1.—Machine Shop, from Gallery, showing 10-Ton Electric Crane and Supports for Shafting. Dynamo Room in Background.

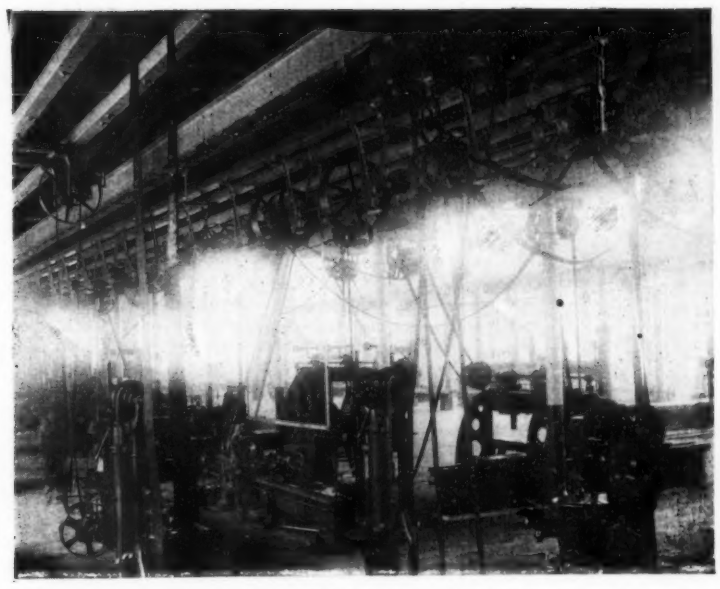


Fig. 2.—General Interior View of Machine Shop looking North from Stairway.

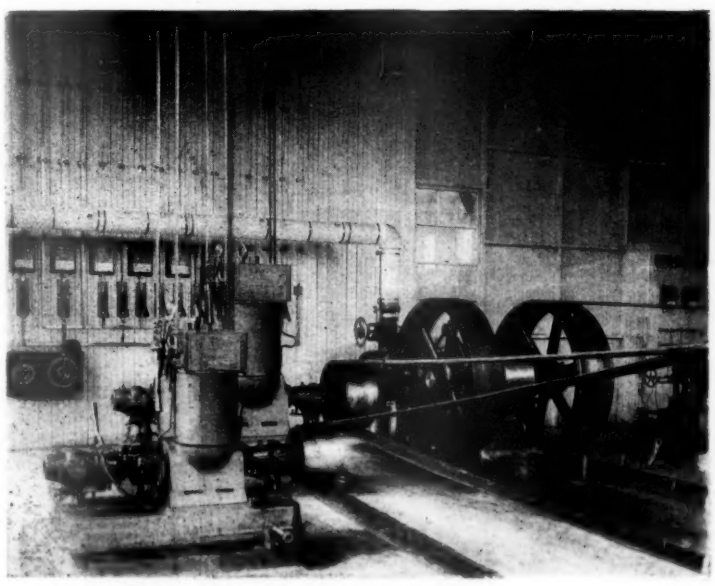


Fig. 4.—Dynamo Room.

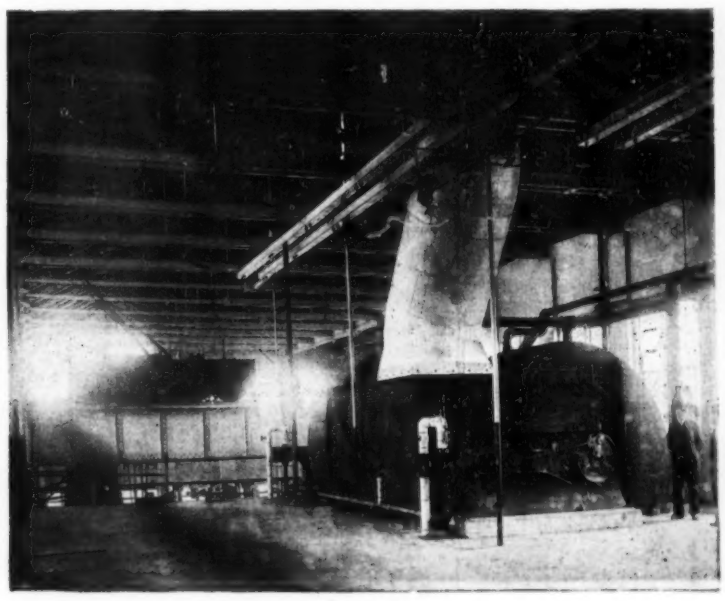
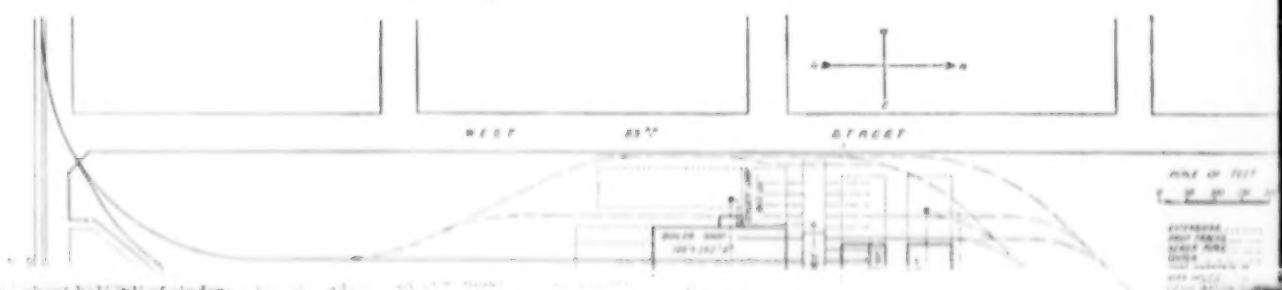


Fig. 5.—Engine and Blowers, Sturtevant Heater System, for Machine and Erecting Shops, in Gallery.



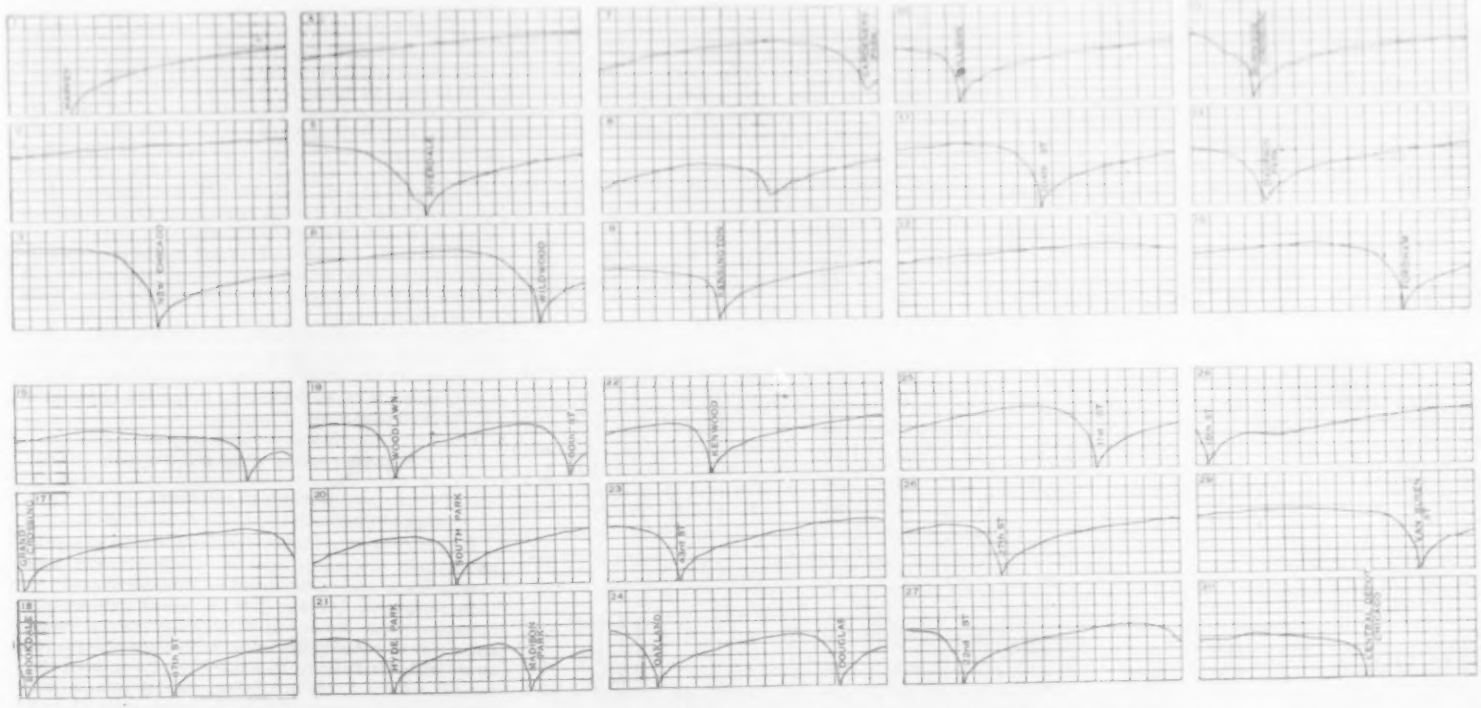
are some of the principal dimensions:

Diameter of cylinder	16 in.
Length of stroke	22 in.
Steam ports	1⅛ × 14½ in.
Exhaust ports	2⅛ × 14½ "
Lap	¾ in.
Travel of valve	5 in.
Diameter of drivers	56½ in.
Rigid wheel base	7 ft. 0 in.
Total wheel base	31 ft. 9¼ in.
Length over all	47 ft. 2⅝ in.
Diameter of boiler	59 in.
Firebox	34⅛ × 56⅛ in.
Number of flues	153
Diameter of flues	2 in.
Length of flues	11 ft. 6⅛ in.
Firebox heating surface	90 sq. ft.
Flue heating surface	888 sq. ft.
Total heating surface	979 sq. ft.
Grate area	14 sq. ft.
Weight on drivers	56,100 lbs.
Weight on leading truck	11,000 "
Weight on trailing truck	46,900 "
Total weight	117,200 "
Water capacity	1,500 galls.
Coal capacity	3½ tons.

[illegible] about half full of cinder[illegible] procured and trips made on May 9, 10, 11, 16 and 17. The run of May 9 was made with 12 cars. On May 10, with 15 cars, the right hand injector was found too small to supply sufficient water, and the left hand injector used. There being no water meter upon the left side, the run was thrown out and a larger injector placed upon the engine. The run of the succeeding day was thrown out because of an uncertainty regarding the amount of coal burned.

Date	May 9.	May 16.	May 17.
Left Calumet	[illegible]	[illegible]	[illegible]
Delays	3 min.	3 min.	3 min.
Arrived at Harvey	11:44	11:44	11:43
Left Harvey	11:51½	11:52	11:51½
Delays			
Arrived at Chicago	1:01¼	1:00¼	1:00
Average steam pressure	197	191	196
Average temperature	64	59	59
Direction of wind	N. E.	S. W.	N. E.
Weather	Cloudy	Clear	Cloudy
Actual evaporation	3.95	3.43	3.63
Equivalent evaporation	4.83	4.16	4.43
Coal used per mile, lbs.	137.6	171.3	159.4
Water used per mile, lbs.	574.9	587.55	516.7
Coal per car mile, lbs.	9.17	11.42	11.38
Water per car mile, lbs.	35.67	39.17	41.39
Coal per 100 ton miles, train, lbs.	55.18	68.56	80.72
Water per 100 ton miles, train, lbs.	214.65	235.16	223.01
Coal per 100 ton miles, total lbs.	44.63	55.53	61.39
Water per 100 ton miles, total lbs.	176.73	190.47	222.84

The vacuum in the smokebox ran to about 7 or 8 in. when the engine was working hard. The temperature of the smokebox averaged about 600°, dropping below at times and running higher when the engine was crowded. The boiler showed from 1 to 4 per cent. of priming when running at high speed with late cut-off and boiler well filled with water.



TESTS OF ILLINOIS CENTRAL SUBURBAN LOCOMOTIVE—SPEED RECORDER DIAGRAMS.

Each vertical division represents five miles an hour; each horizontal division represents 220 ft.

SIX-WHEEL SWITCHING ENGINE NO. 130.

This engine was built by the Brooks Locomotive Works for a switching engine, and is used at present by the Illinois Central on suburban passenger trains. The following are some of the principal dimensions:

Diameter of cylinders	18 in.
Length of stroke	24 in.
Steam ports	1¾ × 16 in.
Exhaust port	2⅝ × 16 in.
Slide valve	Richardson.
Travel of value	5½ in.
Lap	¾ "
Lead	1/32 "
Diameter of drivers	54 "
Diameter of boiler	51 "
Firebox	33⅞ × 77 3/16 in.
Number of flues	206
Diameter of flues	2 in.
Length of flues	9 ft. 7 1/16 in.
Firebox heating surface	106⅛ sq. ft.
Flue " "	1,033⅛ "
Total " "	1,140 "
Grate area	18.25 "
Weight on drivers	84,000 lbs.
Total weight	144,000 "
Water capacity	2,400 galls.
Coal capacity	About 4 tons.

This engine was fitted with a double nozzle 3⅛ in. diameter bridged with ½ in. round iron. It was found to be impossible for this engine to make steam with the coal generally used and haul a heavy train. Several preliminary runs were made and changes made in the adjustment of the valve and in the smokebox before the final test runs were commenced. The test runs were made on May 26 and 28, and June 2. The run on May 26 was made with twelve cars; those of May 28 and June 2 with fifteen cars. The water consumption for the run of May 28 is not given. Meter readings were kept by an employé whose notes for that day were lost. This engine was fitted with all the apparatus used in the two preceding tests with the exception of the pyrometers.

The speed recorder was placed under the tender and belted to a truck axle. It was impossible to place a speed dial where it could be read by the man at the indicator. The point on the road at which indicator cards were taken was noted carefully and the speed at that point taken from the speed recorder diagram after the run was over. The safety valve was set at 155 lbs. Below are given the results of the runs of May 26 and 28 and June 2:

Date	May 26.	May 28.	June 2.
Left Chicago	10:40	10:41	10:40
Delays	4½ min.	3 min.	6 min.
Arrived at Harvey	11:39½	11:44	11:43
Left Harvey	11:50	11:52	11:51
Delays	.....	.....	2 min.
Arrived at Chicago	1:01½	1:02	1:07
Average steam pressure	136	128	120
Average temperature	60	60	58
Direction of wind	W.	S.	N.
Weather	Cloudy	Cloudy	F. ggy
Condition of trial	Dry	Damp	Damp
Feed water temperature	52°	51°	52°
Number of cars	12	15	15
Coal used, lbs.	5,778	6,759	7,110
Water used, lbs.	22,517	.....	24,403
Miles run	39.24	39.24	39.24
Car miles	470.9	588.6	588.6
Ton miles—train	7,871.	9,784.5	9 784.5
Total ton miles	10,696	12,620	12,620
Actual evaporation	3.80	.....	3.43
Equivalent evaporation	4.74	.....	4.17
Coal used per mile, lbs.	147.24	172.24	181.19
Water used per mile, lbs	572.76	.....	621.48
Coal used per car mile, lbs.	12.27	11.48	12.08
Water used per car mile, lbs.	47.73	.....	41.43
Coal per 100 ton miles—train, lbs	73.41	69.07	72.66
Water per 100 ton miles—train, lbs	285.56	.....	249.22
Coal per 100 ton miles—total lbs	54.02	53.56	56.34
Water per 100 ton miles—total, lbs	210.14	.....	493.25

The vacuum in the smokebox of this engine ran to 8 and 9 in. when doing heavy work. No priming was shown by the calorimeter at any time.

AVERAGES.

Below are given in tabulated form the results of the final test runs. The tables give the actual cost of coal per mile, coal per car mile, coal per 100 ton miles for train (back of tender), and coal per 100 ton miles for total trains—engine and tender included—and based upon the actual cost of coal on tenders, which is as follows:

Anthracite pea, per ton	$2.85
Bituminous coal, per ton	1.85

Engine No. 623.

Date	Apr. 23.	Apr. 26.	Apr. 27.
No. of cars	15	14	15
Coal used, anthracite, lbs.	5,025	5,040	4,930
Water used, lbs.	22,868	22,871	23,367
Actual evaporation	4.56	4.52	4.79
Equivalent evaporation	5.62	5.56	5.90
Water used per mile, lbs.	583.68	580.37	601.00
Water used per car mile, lbs.	38.90	41.45	40.10
Water used per 100 ton miles, train lbs.	234.16	248.46	241.32
Water used per 100 ton miles, total lbs.	177.38	185.32	182.50
Coal used per mile, lbs.	128.00	128.40	125.50
Coal used per car mile, lbs.	8.53	9.17	8.37
Coal used per 100 ton miles, train lbs.	51.35	54.97	50.38
Coal used per 100 ton miles, total lbs.	38.90	41.00	38.10
Cost of coal per mile, cts.	18.240	18.298	17.885
Cost of coal per car mile, cts.	1.2155	1.3057	1.1927
Cost of coal per 100 ton miles, train cts.	7.3163	7.8315	7.1995
Cost of coal per 100 ton miles, total cts.	5.5425	5.8413	5.429

Engine No. 211.

Date	May 9	May 16	May 17
Number of cars	15	15	12
Coal used, bituminous, lbs.	5,400	6,719	6,253
Water used, lbs.	21,403	25,050	22,689
Actual evaporation	3.96	3.43	3.63
Equivalent evaporation	4.83	4.18	4.43
Water used per mile, lbs	574.90	687.55	546.70
Water used per car mile, lbs.	35.67	39.17	41.30
Water used per 100 ton miles—train, lbs.	214.65	235.16	293.01
Water used per 100 ton miles—total, lbs.	176.73	190.47	222.84

Engine No. 211.

Date	May 9	May 16	May 17
Coal used per mile, lbs.	137.60	171.30	159.40
Coal used per car mile, lbs	9.17	11.42	11.38
Coal used per 100 ton miles—train, lbs.	55.18	68.56	60.72
Coal used per 100 ton miles—total, lbs.	44.63	55.53	61.30
Cost of coal per mile, cts.	12.728	15.85	14.746
Cost of coal per car mile, cts.	0.8482	1.0563	1.0527
Cost of coal per 100 ton miles—train, cts.	5.1020	6.3420	7.4665
Cost of coal per 100 ton miles—total, cts.	4.1285	5.1360	5.6790

Engine No. 130.

Date.	May 26.	May 28.	June 2.
Number of cars	12	15	15
Coal used, bituminous, lbs.	5,778	6,759	7,110
Water used, lbs.	22,517	.....	24,403
Actual evaporation	3.89	.....	3.43
Equivalent evaporation	4.74	.....	4.17
Water used per mile, lbs.	572.76	.....	621.48
Water used per car mile, lbs	47.73	.....	41 43
Water used per ton miles, train, lbs	235.56	.....	249.22
Water used per 100 ton miles, total, lbs.	210.14	.....	193.25
Coal used per mile, lbs.	147.24	172.24	181.19
Coal used per car mile, lbs.	12.27	11.48	12.08
Coal used per 100 ton miles, train, lbs.	73.41	69.07	72.66
Coal used per 100 ton miles, total, lbs	54.02	53.56	56.34
Cost of coal per mile, cts.	13.62	15.93	16.76
Cost of coal per car mile, cts.	1.135	1.062	1.117
Cost of coal per 100 ton miles, train, cts.	6.791	6 389	6.722
Cost of coal per 100 ton miler, total, cts	4.997	4.954	5.212

In the following table are given the various detail measurements taken from the indicator cards illustrated with this. The numbers on the cards refer to numbers in the tables.

The speed recorder diagrams explain themselves. They are interesting as being the first ever taken on such a large scale, viz.: 12 in. of paper per mile run. Each vertical division corresponds to a speed of five miles an hour. The horizontal spaces correspond to 220 ft. length of track, the paper being stationary when the engine is not moving.

Sheet M. Compound Engine No. 623. Chicago to Harvey.

Card No.	Speed.	Steam Pressure.	Cut-Off.	Back Pressure.	Average M. E. P.	Indicated H. P.
			Notch.			
1.....	25	180	2	6	H. 84.0 L. 36.8	697.4
2.....	34	175	1	10	H. 68.0 L. 28.8	754.0
3.....	37	150	2	11	H. 68.8 L. 28.8	824.8
4.....	28	190	2	8	H. 79.2 L. 33.6	761.1
5.....	25	190	2	9	H. 90.4 L. 40.0	754.6
6.....	34	175	2	9	H. 72.0 L. 28.0	762.9

Sheet N. Compound Engine No. 623. Harvey to Chicago.

			Notch.			
1.....	30	150	2	11	H. 75.2 L. 33.6	737.6
2.....	28	174	3	11	H. 81.2 L. 35.2	750.7
3.....	25	170	3	10	H. 82.4 L. 36.0	683.0
4.....	19	181	4	6	H. 98.4 L. 49.6	671.7
5.....	28	180	3	13	H. 79.2 L. 33.6	723.8
6.....	35	180	2	11	H. 82.4 L. 36.8	691.7

Sheet Q. Simple Engine No. 211. Chicago to Harvey.

			Inches.			
1....	2	147	20	2	127.0	57.50
2....	6	140	17	7	112.0	168.63
3....	10	140	20	4	112.0	297.70
4....	10	140	15	6	100.0	285.80
5....	17	135	16.5	6	102 0	469.20
6....	18	138	12	4	92.2	440.6
7....	20	133	12.5	6	91.0	483.8
8....	22	127	11	5	70.2	398.7
9....	25	135	10.5	5	80.5	535.1
10....	30	130	11	6	71.2	568 2
11....	31	131	10 5	7	67.0	521.0
12....	36	132	8.5	5	51.5	487.6

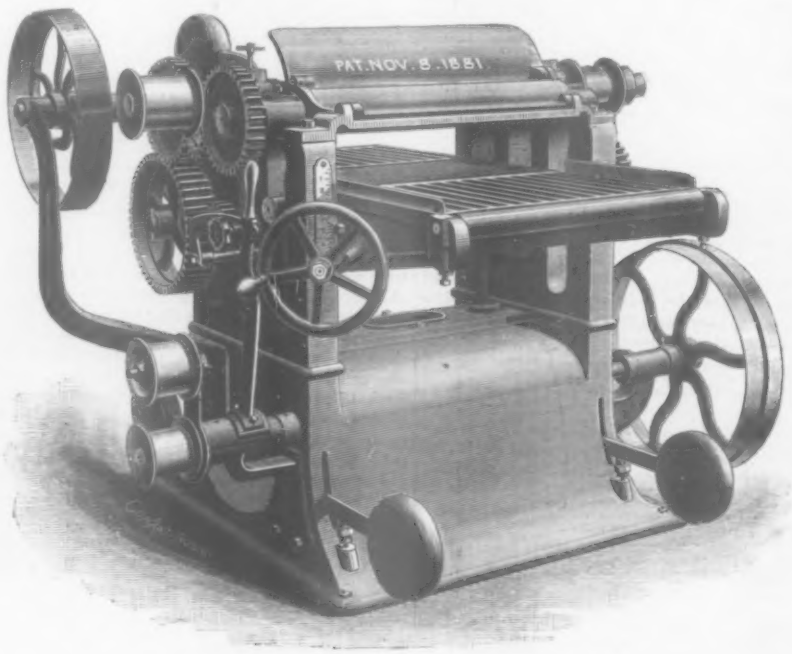
Improved Concord Planer.

This machine has been on the market many years, and is so well known that we give only a short description of its principal features in the improved form now made.

The frame, although of the same general appearance as in earlier machines, is now made with the base cast solid, the side pieces, carrying the cylinder and roll bearings, being securely bolted to it, so that the frame will not cramp or thrust the boxes out of line.

The bed is raised and lowered by means of a hand wheel in front of the machine, operating by a train of gears upon two steel screws 1¼ in. in diameter, with gun metal nuts 3 in. long. One revolution of the hand wheel changes the elevation of the bed one-sixteenth of an inch.

The feed rolls are so arranged that each is positively driven, but without the number of gears usually employed for the purpose, thus effecting a considerable saving in power.



IMPROVED CONCORD PLANER—24-IN. SIZE.

The cylinder is double belted and formed from a single piece of best forged steel with faces accurately planed and turned to 1⅝ in. at the journals. The knives are held in place by ¾-in. Norway iron bolts, the cutting edges describing a circle 5 in. in diameter. The cylinder bearings are 9 in. long, lined with babbitt and accurately fitted and tested. The chip breaker is so arranged that it cannot come in contact with the knives nor become wedged in taking the heaviest cut. The pressure bar is weighted, and thus made to yield slightly to inequalities of stock, so as to prevent "sticking."

All parts are made strictly to gauge and interchangeable, the number of the piece being cast or stamped upon it, facilitating repairs or renewal of wearing parts whenever necessary.

The weight of the machine is 2,200 lbs., and it will plane stock from ⅛-in. to 10 in. thick. It is made in widths of 20, 27 and 30 in., the two latter sizes taking stock up to 12 in. in thickness. It is made by the John A. White Co., of Dover, N. H.

Night Signaling—Past and Present.

BY ARTHUR H. JOHNSON,
Signal Engineer, N. Y. L. E. & W. R. R.

For many years after the introduction of fixed signals on railroads the lamps used for night signaling were very inferior, and many were the complaints made by those concerned. At that time the use of petroleum or kerosene oil for lamps was in its experimental stage, and a way of refining the oil so as to a great extent do away with its liability to explode had not been discovered. Animal oils and sperm candles were in universal use, and, as was afterwards shown, such oils will not compare with kerosene for illuminating purposes. The construction of the oil box, burner and lamp case, necessary to afford good breathing ports were not thoroughly understood. At length someone in America

discovered a process by which kerosene could be safely used in all households, and a huge market was at once found in England for this natural oil.

The constructors of railroad signal lamps had been looking forward to this development and at once set to work to construct suitable lamps to burn the new oil. By experimenting with this application, great progress was finally made in the details of lamp construction. So many lamps were required for the railways that signal lamp making became a separate industry, and great was the competition between the various concerns engaged in the business.

It early became apparent that the chief requirements were as follows: viz. (1). The free ingress and egress of air and gases, at the same time so guarding the flame by baffle plates as to prevent the light from being extinguished in stormy weather. The lamp must draw a good supply of air in still hot weather. (2). The oil box to be so constructed as to best keep the oil cool. (3). The burner to be constructed so as to direct the current of fresh air to the point of combustion. (4). The lens to be proportioned to the flame, and focused so as to throw nearly all the light equally distributed, and within the limits of the very acute angled cone. (5). The lamp case carrying the lens to be firmly fastened to the signal post, so that the centre line of the cone of light could be permanently fixed.

The form of lamp finally conceded by most of the roads to best meet the requirements answers to the following description: An outer cylindrical case, carrying a 6-in. plane-convex lens, and having a hinged top with snap fastening. The top carries a large hood and baffle plates for escape of gases. Air is admitted at the bottom by round holes. The outside case is firmly secured by means of a light cast-iron bracket to the signal post. Inside there is a square skeleton case, glazed all four sides, with door and a handle for carrying. The oil box is so constructed that the wick rests in an isolated chamber, which communicates with the main reservoir by small ducts. The cool air is made to pass completely through the middle of the oil box and reach the flame. There is a full description of this lamp in the *Railroad Gazette*, Oct. 24, 1890. This lamp was in general use in England, and in connection with the interlocking on the Continent, when the first Saxby & Farmer machine was erected in this country (at East Newark Junction), and I understand that the same form of lamp is in general use over there at the present time.

Instead of realizing that the night signals were at least equal in importance to the day signals, we directly departed from the result of years of experience as crystallized in the original lamps at East Newark and Perth Amboy Junctions, Pennsylvania Railroad, and have cast about for the cheapest possible signal lamps. With this end in view a small corrugated lens was adopted because it was cheap, and mounted in a small tin case.

A cheap oil box and burner were inserted in the case and the complete lamp placed on a hook, where it wobbles to this day. Thus at a single step we ignored the experience presented to us gratis, and went back to the barn yard lamp.

Presently came the old grumblings from enginemen and others concerned, about the indistinctness of the night signals and their liability to be mistaken for other lights and vice versa. The English roads, it will be remembered, silenced these complaints by improving the lamps and displaying powerful lights. Not knowing that in the main part this question had been thereby solved, several inventors hit upon a plan of illuminating the signal arm, so as to make a night semaphore signal, because, said they, "uniformity is what railroads require, therefore, why not make a night as well as a day semaphore." It seems to me that it would be just as logical to expect that because a plain red light is extremely arrestive as a signal by night, that such would be the case with a red disc of the same size by day. Setting aside the cost of illuminated blades, which are at least twice as expensive as those lamps at East Newark Junction, Dr. Jeffries and other eminent authorities have concluded that we have to principally rely on the intensity and distinct color of lights for good night signaling.

I do not wish it to be understood that I consider the English practice in night signaling approaches perfection, for I admit that in a few cases the back ground of city lights may be such as to be dangerous in case of the extinction of the signal light. But the obviation of this danger has never been seriously taken up in connection with the use of signal lamps. Would it not be well to convert the ordinary light into a flash light in such cases? I believe that several people have invented means for accomplishing this. If a white flash light and a still red light were used in all cases for main line signals, there would be no object in using green for "all clear," thus leaving us the unrestricted use of green for distant signals. I don't think that many people are aware that all the English distant signals show a red light in the danger position.

By the way, why has the horizontal position of the distant signal come to be termed the caution position, taking into consideration the fact that the distant is the most important signal whereby to stop a fast train? The distant in the horizontal position always used to be spoken of as at danger, and in that position it is most certainly a danger signal. Of course in our case where we are content, in many cases, to dispense with distant signals, even in block working, the use of red for distants might lead to serious mistakes.

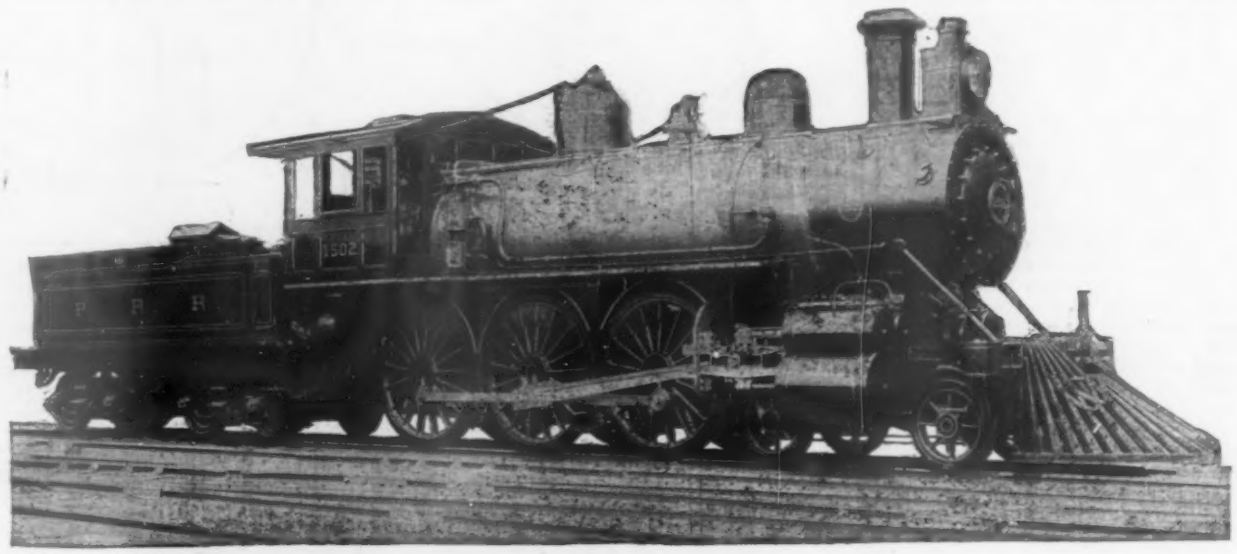
Then there is the peculiar idea that we should not expect an engineman to accept a clear signal which is on the same post as the red lights. Surely, considering that the white light simply signifies that there is permission to pass the signal post and proceed on a certain track the other red lights serve to emphasize which track is clear. The argument might, with equal propriety, be applied to day signals.

In conclusion, I may be permitted to suggest that criticism with regard to night signaling is almost worthless unless the critic has practically studied the matter in the locomotive cab of a fast night train.

Compound Passenger Locomotive for the Pennsylvania.

The engraving printed herewith shows a 10-wheel compound passenger locomotive recently built by the Baldwin Locomotive Works, of Philadelphia, for the Pennsylvania Railroad. We have already stated, in previous issues, that the Pennsylvania is to test in its fast train service a number of locomotives of various patterns from different builders. The engine which we now illustrate is practically a duplicate of that built at the same shops for the committee of the Master Mechanics' Association, which was described in the *Railroad Gazette* of Jan. 8 last. The principal dimensions of that engine are as follows:

Weight of engine in working order, 133,000 lbs.
Weight on driving wheels, 100,000 lbs.
Cylinders: high pressure, 14 × 24; low pressure, 24 × 24.
Driving wheels: 72 in. diameter, 66 in. centres.
Total wheel base, 24 ft. 2 in.; driving wheel-base, 12 ft. 6 in.
Straight-top boiler 62 in. diameter at smokebox end, with 270 2-in. tubes, 14 ft. long.
Firebox 120 in. long by 34 in. wide.
Working pressure, 180 lbs.
Grates, rocking, with drop.
Driving axle journals, 8 × 8½ in.
Truck wheels, 33¼ in. diameter, with wrought-iron spoke centres, and steel tires held by retaining rings.
Engine truck journals, 5 × 10 in.
Tender, 3,600 gallons capacity, fitted with water scoop.
Tender wheels 36 in. diameter.
Tender journal axles, 4 × 8 in.
Feed water supplied by two Sellers' 1877 No. 9½ injectors.
Westinghouse automatic brake on all driving and tender wheels, and Westinghouse train signals.
United States metallic packing for piston rods and valve stems.
Nathan sight feed lubricator.
Side rods with solid ends and bronze bushings.
Steam heating connections, Pennsylvania Railroad standard



COMPOUND PASSENGER LOCOMOTIVE—PENNSYLVANIA RAILROAD.

Built by the BALDWIN LOCOMOTIVE WORKS, *Philadelphia, Pa.*

Passenger Traffic of Boston Railroads.

A gain of over 4,000,000 passengers in one year may be regarded as a fair increase in business for the five railroad companies running trains out of Boston, while an addition of more than 3,000,000 to the number of people brought into and carried out of that city indicates a healthy growth in the suburban population. A careful study of the annual reports of the several railroad companies shows these figures for last year, and also brings out many interesting facts relative to the business of the roads. While there are actually eight separate and distinct standard gauge railroads entering Boston, each having its separate and distinct terminal facilities and stations, consolidations have resulted in leaving only five operating companies, and some people believe that within a few years one corporation will run all the roads on the north and another those on the south side of the city.

Although these five companies are known as Massachusetts corporations and their business is credited in that State, out of the 3,100 miles of railroad operated by them only a little over half, or 1,733, miles are located within the borders of the commonwealth, and although these five corporations operate 3,100 miles of railroad they own only a little more than one-half that number of miles. These facts are shown in the following table of miles of road:

Corporations.	Owned.	Operated.	Operated in Massachusetts.
Boston & Albany	305.60	398.73	332.10
Boston & Maine	315.70	1,210.03	672.48
Fitchburg	372.48	435.32	238.09
New York & New England	359.93	496.34	147.89
Old Colony	482.38	569.11	542.50
Totals	1,836.09	3,100.53	1,733.06

In the number of passengers carried during the year the Fitchburg road shows the largest per cent. of increase, though the smallest number of people transported.

The passenger statistics are summarized in the following table:

PASSENGER TRAFFIC.

Corporations.	No. passengers.	Passenger mileage.	Gain in passengers.
Boston & Albany	11,371,636	211,852,182	3.3 per ct. over 1890-1.
Boston & Maine	31,174,544	413,313,594	5.0 " " "
Fitchburg	6,795,423	106,427,328	10.0 " " "
N. Y. & N. Eng.	8,212,400	105,080,791	7.0 " " "
Old Colony	22,395,487	263,581,669	4.9 " " "
Totals	79,949,490	1,100,255,564	

The Boston & Albany and the Old Colony were the only roads that increased the average distance per passenger, the former gaining 0.35 of a mile, and the latter .07. The Boston & Maine lost .06 of a mile on each passenger, the Fitchburg .37 of a mile, and the New York & New England .62 of a mile.

This glance at the general passenger traffic of the standard guage roads radiating from Boston indicates the extent of the business, but the most interesting facts are found in a study of the statistics showing the amount of the traffic to and directly connected with that city. Although these roads traverse over 3,000 miles, more than three-fifths of the number of passengers transported are brought in or carried out of the city. But that does not show the actual movement of the business in and out of Boston. The little narrow gauge road, the Boston, Revere Beach & Lynn, is an important factor, for though only six miles long it came very near carrying as many passengers last year as either the New York & New England or the Fitchburg. In treating of the passenger business of Boston the B., R. B. & L. is to be considered. But even that does not show all the

traffic, for the West End Street Railway reaches stations on the Boston & Albany, on the Fitchburg, on the Boston & Maine, on the Old Colony, and on the New York & New England. It is impossible to give any reliable figures concerning the amount of the suburban business done by the West End road from these stations, but it is large, and the increasing use of electricity is making the company a still stronger competitor with the steam roads.

Taking the six steam roads then, it is found that during twelve months they brought into Boston 25,612,001 passengers, and 25,682,797 were carried out. In other words, 51,294,798 people were taken in and out of Boston in one year, or an average of 140,531 every day. This was a gain of over 8,800 per day, or 3,222,322 for the 365 days. Of the six companies the Boston & Maine was far ahead in the number of passengers, and the Old Colony came next. But the Boston & Maine really consists of three separate roads, each having its terminal station, namely, the Boston & Maine, the Eastern and the Boston & Lowell, and each of these roads does a large suburban business. The Old Colony consists of two separate roads, each with its terminal station—the Old Colony and the Boston & Providence. Averaging the Boston & Maine's figures, it will be seen that each of its roads carried 7,005,357 passengers, and serving the Old Colony the same way its two roads averaged 6,511,893 passengers. The Boston & Albany thus appears to have done the largest business of any single road, its figures showing 7,024,170 passengers.

A comparison of the increase of the general and the Boston business of the several roads is interesting. The Fitchburg road made the largest per cent. of gain in both branches, but while it gained 10 per cent. on all passenger business it increased 11.62 per cent. on its Boston traffic. The New York & New England road also made a larger per cent. of gain on Boston business than on all its traffic; the record shows that while on the latter its increase was 7 per cent., on the former it was 9.32 per cent. The Boston & Maine had 6.72 per cent. more Boston business than the previous year, while on all its business the gain was only 5 per cent. The Boston & Albany also made its largest increase on Boston traffic, 5 82 per cent., while on all business it was only 3.3 per cent. For some reason the Old Colony road stands alone in showing a less relative gain on Boston traffic than on its entire business. While it increased 4.9 per cent. on its whole passenger traffic its increase on Boston business was only 3.82 per cent. It is possible that the putting on of electric cars by the West End road in competition with the Old Colony at a number of stations may have reduced the suburban traffic. The Revere Beach road gained 4.8 per cent. on its traffic over the previous year.

The number of passengers carried by all the roads was very evenly divided between inward and outward bound. The number to Boston was 25,612,001, and the number out of the city was 25,682,797, showing a difference of only 70,796, or about 194 per day for all the roads. The following tabular statement presents the figures of Boston traffic in a form for easy comparison :

Companies.	To Boston.	From Boston.	Total.	Increase over 1890.	
				No	%
Boston & Albany...	3,502,585	3 521,585	7,024,170	409,019	5.82
Boston & Maine....	10,543,954	10,472,116	21,016,070	1,414,053	6 72
Fitchburg.....	1,976,321	2,017,338	3,993,657	464,128	11.62
N. Y. & New Eng	1,736,398	1,716.917	3,453,315	321,707	9.32
Old Colony.....	6,470,706	6,553,089	13,023,786	179,842	3.82
Boston, Revere Beach & Lynn....	1,382,037	1,401,761	2,783,798	133,571	4.80
Totals.....	25,612,001	25.682,797	51,294,798	3 222,320	.....

Western Railway Club—May Meeting.

The regular monthly meeting of the Western Railway Club was held in its rooms, Rookery Building, on May 17. Mr. W. H. Lewis read a paper on "The Design and Correct Proportions for Locomotive Smokestacks and Exhaust Nozzles."

Mr. Lewis began by quoting from a report of the Master Mechanics' Association as follows: "The committee has had considerable experience with both straight and taper stacks, and is of the opinion that the stack with the double taper is decidedly the best, and that the size of the stack has a very marked effect upon the steaming, with any given nozzle. Reduction of stack diameters will generally permit of increase in nozzle diameters. . . . The reduction of the stack near its base with a double taper is not a mere theory, but is a recognized scientific principle known as the contracted vein. . . ."

While considering this principle is occurred to me that the same form might be used in the exhaust pipe, carrying out the full lines as laid down in Trautwine [Fig. 10, page 200, edition of 1887.—EDITOR], as shown in the accompanying sketch, No. 1, the top of the pipe being on a line with the base of the stack. This, however, defeated all that we had gained by improving the shape of the stack for it prevented a proper combination of the gases with the exhaust at the line of contraction. I reduced the height gradually, as shown by lines *A*, *B*, *C*, *D*, . . . and while I have not yet succeeded in establishing the correct relations between the top of the pipe and the stack, I still think the principle correct, and that its use will result in a decrease of back pressure in the cylinders as well as a milder draft, which will lead to full economy. The developments in connection with the compound locomotive have demonstrated that steam can be maintained with a milder draft than is usually employed in a simple engine, and a large share of the fuel economy effected in compound locomotives is due, I believe, to this cause. . . . With an exhaust pipe as shown in Fig. 2, in. which the bridge approaches within 8 in. of the nozzle,

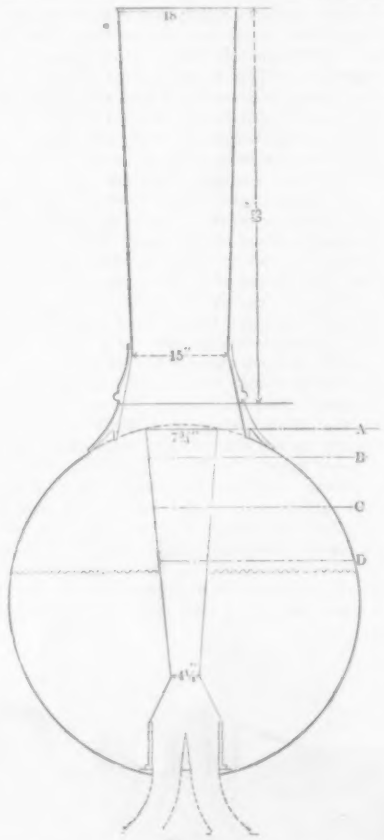


Fig. 1.

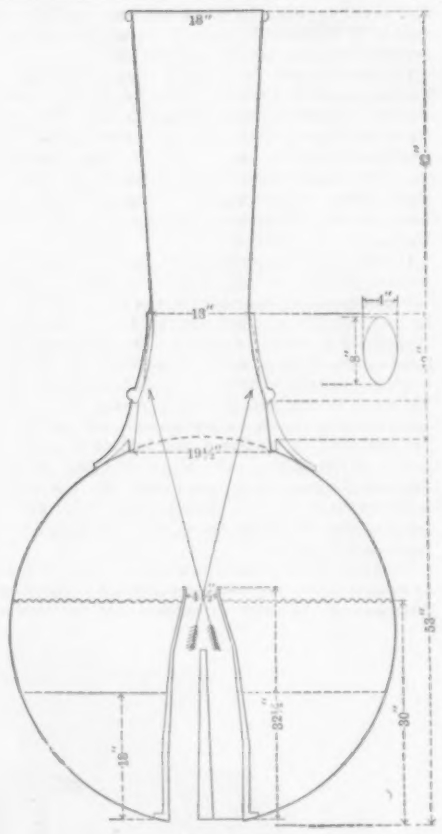


Fig. 2.

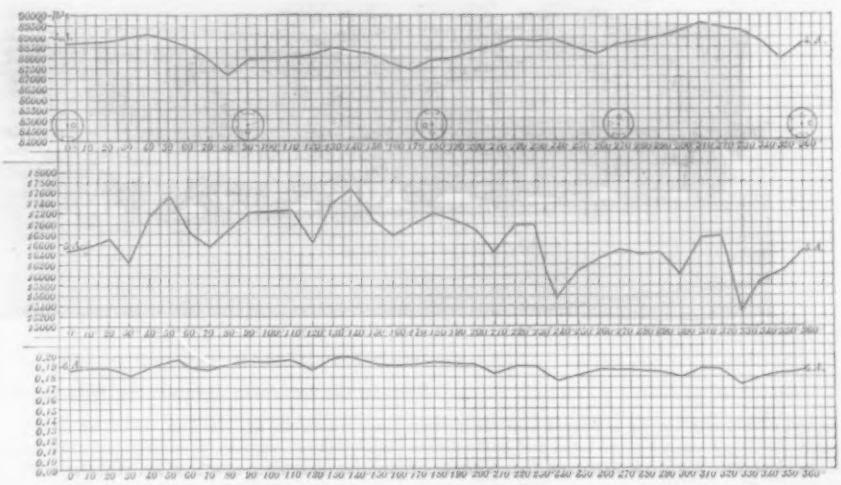


Fig. 1—Data for 10 miles an hour.

Data applicable to ten-wheel locomotive with 60½-in. drivers and 19 × 26-in. cylinders.

IRREGULAR WEAR OF DRIVING WHEEL TIRES.

the effect was to send the steam from side to side, and in three months I found each side of the stack base cut out to a depth of ¼ in. in the form of an ellipse which was 8 in. long and 4 in. wide. . . . The column of steam continues on in the same angle at which it approaches the exhaust tip. This points to the necessity of a low bridge that will allow the column to straighten before it reaches the nozzle. The momentum of the exhaust will insure its upward tendency, with a very slight bridge at the base of the exhaust pipe. The possible improvements in this direction are increased economy in fuel consumption and increased power of the engine by the removal of back pressure in the cylinders. . . .

In an informal discussion of this paper, Mr. J. N. Barr, of the Chicago, Milwaukee & St. Paul, said that he once made quite a number of experiments on exhaust

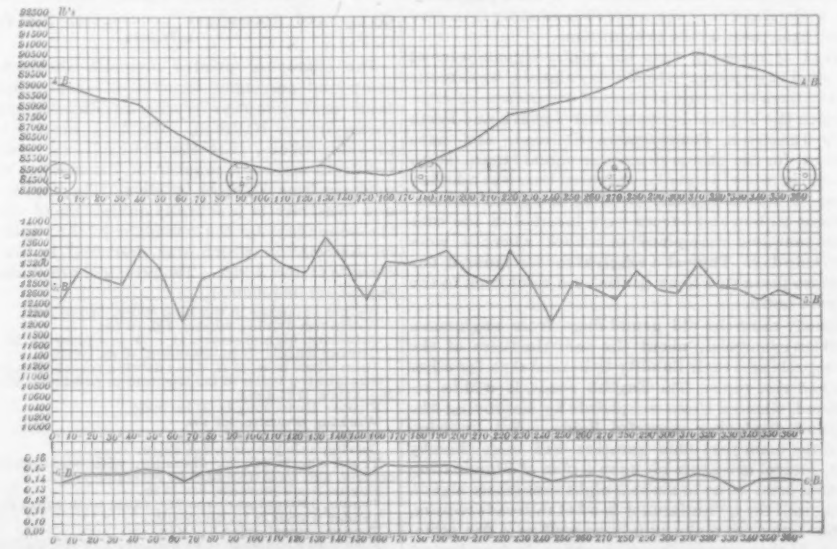


Fig. 2—Data for 20 miles an hour.

pipes and nozzles, "and when I got through I was satisfied that I knew less than when I began."

The subject of coach cleaning was discussed by Mr. Barr, Mr. Lewis, Mr. Files and Mr. Townsend. The general view of those present was that soap and water was the best substance for cleaning coaches. The Chicago & Alton uses a weak solution of oxalic acid and finds it quite efficient.

Mr. E. M. Herr, formerly Master Mechanic of the Chicago, Milwaukee & St. Paul, and now Superintendent of the Grant Locomotive Works, read the following paper on

IRREGULAR WEAR OF LOCOMOTIVE DRIVING-WHEEL TIRES.

At the February meeting of this club in 1881, Mr. J. N. Barr read a paper on this subject, giving data in regard to a particular case of irregular tire wear. Shortly after this time the writer arranged to systematically measure the irregularities of tire wear of all locomotive driving-wheels passing through the principal shop of the C., M. & St. P. at Milwaukee. In addition to making these measurements the weight of counterbalance in the wheels was taken and all rods and reciprocating parts were also weighed. The engines passing through this shop include eight-wheel freight and passenger engines, switch engines and ten-wheel freight engines. The latter only will be considered in this paper. The following are the principal dimensions and weights necessary to determine the rotative force and pressure of each wheel on rail at various speeds and all positions of crank.

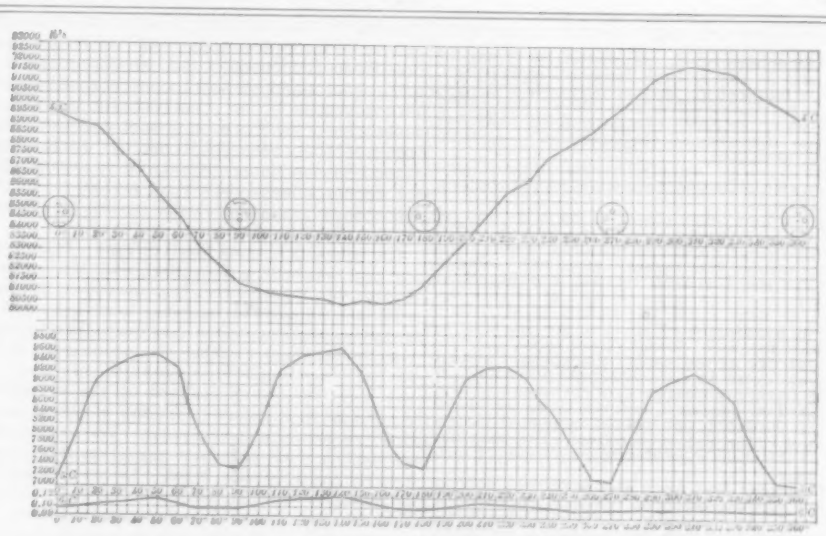


Fig. 3—Data for 30 miles an hour.

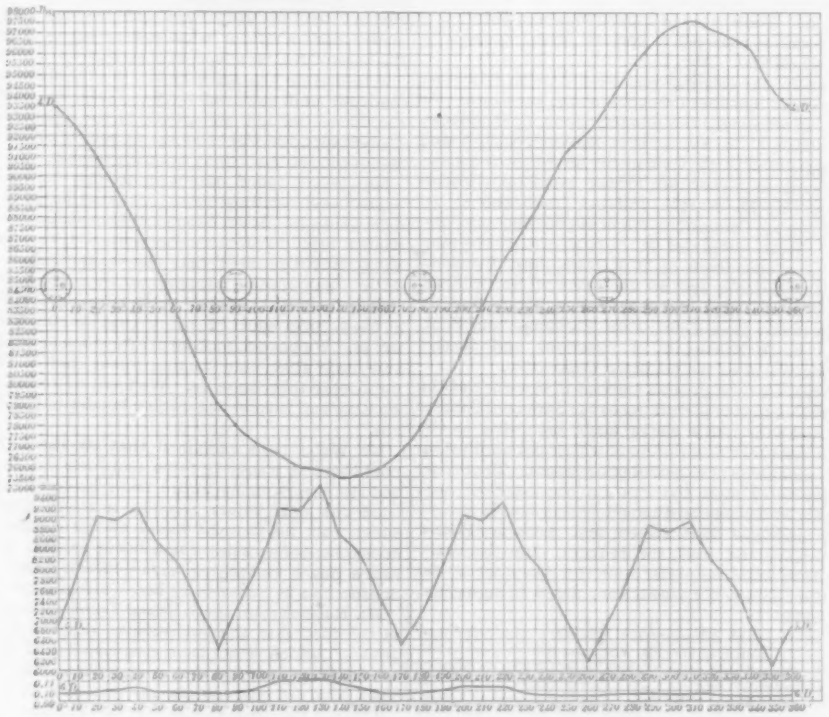


Fig. 4—Data for 40 miles an hour.

The tires of 53 of this class of engine were measured. Unfortunately they were not all counterbalanced alike, but all agreed in having the forward and back wheels overbalanced, and the middle or main wheels underbalanced statically in 70 per cent. of the engines, and in all cases underbalanced according to the rule now followed on the C. M. & St. P., of adding to the weight necessary to balance the revolving weights two-thirds of the weight of the reciprocating parts, divided equally between the wheels. The weights of overbalance in forward and back wheels and underbalance in main wheel average as follows:

Front wheel, actual average overbalance, weighed at crank-pin, 271 lbs.
Main wheel, actual average underbalance, weighed at crank-pin, 80 lbs.
Back wheel, actual average overbalance, weighed at crank-pin, 237 lbs.

The following formulæ have been used in determining the forces in action:

Cylinders, 19 in. diameter.
Stroke, 26 in.
Drivers, new tire, 62 in.; taken here at 60½ in.
Length of main rod, 10 ft.
Diameter of piston rod, 3¼ in.
Total weight of drivers, 84,000 lbs., distributed equally.
Weight of reciprocating parts, viz., piston, piston rod, crosshead and forward end of main rod, 729 lbs.
Steam pressure, 150 lbs.
Weight of back end of main rod taken as a revolving weight.

Notation.

P Pressure of each wheel on rail.
W Weight of each wheel on rail, engine at rest.
C Centrifugal force of overbalance.
R Rotative force at rail from one cylinder.
A Acceleration of reciprocating parts.
p Resultant pressure against piston.
S Length of stroke.
n Ratio of length of main rod to length of crank.
d Diameter of drivers.
d Angle of crank with horizontal.
B Angle of main rod with horizontal.

Hence—

$$P = W + C \sin a + \frac{(p + A)}{\sqrt{\frac{n^2}{\sin^2 d} - 1}}$$

$$R = (p + A)\left(\sin d - \frac{\cos d}{\sqrt{\frac{n^2}{\sin^2 a} - 1}} \right) \frac{S}{D}$$

The point 0° is taken, in all tables and diagrams that follow, at the point of contact between tire and rail of wheels on right side of engine, with the right crank on the forward centre, positive rotation being that produced by running the engine forward. The values "*P*" and "*R*" have been calculated for every 10 degrees of revolution of each wheel at four speeds, 10, 20, 30 and 40 miles per hour. The pressures upon the piston used in these calculations were obtained from actual indicator cards taken at these speeds, and with a point of cut-off found by the examination of a large number of cards to be the usual point at which engine is worked in freight service at the speed taken. The points of cut-off used are: At 10 miles an hour, 13 in.; 20 miles an hour, 11 in.; 30 miles an hour, 8 in., and 40 miles an hour, 6 in.

The results of these calculations for each of the wheels on the right side of the engine are shown in the diagrams, Figs. 1, 2, 3, 4 and 5. For the left wheels the figures are the same, but the corresponding points are one-quarter of a revolution back of those on right wheel, on account of the right crank leading one-quarter. The total weight of all drivers on rail, the total rotative force at rail and the coefficient of slip are shown in diagrams 1, 2, 3 and 4. The coefficient of slip is obtained by dividing the total rotative force at the rail by the total weight on rail. When this coefficient of slip equals the coefficient of friction between tire and rail, the engine is at the point of slipping; therefore, the maximum values of the coefficient of slip indicate the points where the engine is most likely to slip the drivers.

Diagram No. 1 is for a speed of 10 miles an hour; No. 2, 20 miles an hour; No. 3, 30 miles an hour, and No. 4, 40 miles an hour.

An inspection of curves 4A, 4B, 4C and 4D shows the wide variation in the total pressure on rail at speeds no higher than 40 miles an hour with an engine counterbalanced much better than many in regular service. The variation in the weight on the rail in the forward and back wheels is, of course, due entirely to the centrifugal force of the overbalance and amounts, at 40 miles an hour, to a difference in total pressure on the rail of over 20,000 lbs. As this varies with the square of the speed, the importance of keeping the overbalance as low as possible is evident. This means reducing the weight of the reciprocating parts to the minimum, and adding to the counterbalance necessary to balance the revolving parts as small a part of the weight of the reciprocating parts as is consistent with a good riding and smooth working engine.

Curves 4A and 4B in diagrams 1 and 2 show the total weight on drivers to be always greater than the actual weight of engine. This, at first sight, looks anomalous, but is due to the angularity of the main rod always causing an increase of pressure on the main wheel. There is, of course, a corresponding upward pressure on the guides, reducing the weight on the truck.

Curves 5A, 5B, 5C and 5D, show the variation in the

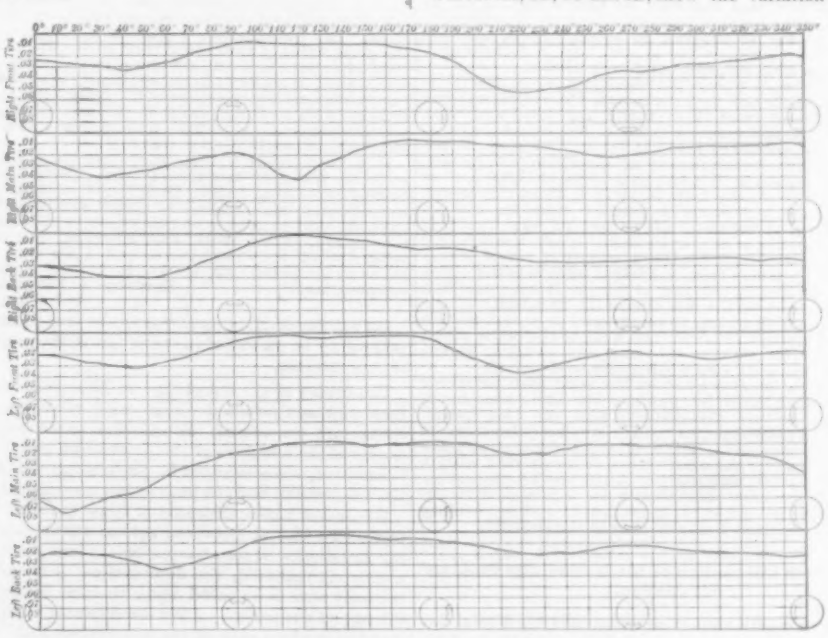


Fig. 5—Irregular Wear of Driving Wheel Tires.

Averages of data from 53 ten-wheel locomotives.

rotative or tractive force of the engine at various speeds and different points of cut-off. These indicate that this engine would pull more steadily at about a speed of 20 miles an hour than at either higher or lower speeds. The rotative force is, of course, affected by changes in the cut-off, but at high speeds the inertia of the reciprocating parts becomes the more important and materially affects the steadiness of the engine, regardless of the amount of steam worked. This is readily seen in any engine by an inspection of the diagram of a dynamom-

eter car taken at high speed. Curves 6A, 6B, 6C and 6D give the ratio of the rotative force to weight on rail, which I have followed Mr. Barr in calling the coefficient of slip. The maximum values here follow quite closely the maximum of the curve of rotative force, and it has its maximum value, for all speeds shown, between 130 degrees and 140 degrees.

Diagram 5 shows the average irregular wear of each of the driving wheel tires of 53 ten-wheel freight engines, obtained as follows:

Each pair of tires when placed in the lathe was rotated and the highest point of worn tread found. A bar of steel with end cut off square placed in the tool rest is brought against the highest spot and securely clamped. The wheel is then rotated, if necessary, to bring the 0 degree point opposite the end of this bar. The depth of wear below the highest point is then measured in hundredths of an inch by inserting as many metal strips, each exactly $\frac{1}{100}$-in. thick, between bar end and tire as the space will admit. Similar measurements every 10 degrees around the wheel are made. An average of measurements so made for 53 engines is platted on diagram 5, each tire being considered developed on the datum line and the amount of wear in hundredths of inches platted therefrom. The diagrams of wheels on this sheet show clearly the position of each tire on its wheel.

We will consider first front and back tires only, as these wheels were overbalanced, the main wheels being underbalanced. An inspection of the diagram shows quite uniformly in both tires, two locations of maximum wear, one beginning at about 160 deg. and attaining its maximum at 220 deg. or 230 deg., the other becoming pronounced at about 10 deg. or 20 deg. and attaining its maximum at about 50 deg. It will also be noted that both of these low spots are connected from 220 deg. to 50 deg. in the direction of rotation by a portion of the tire much more worn than that portion from 50 deg. to 220 deg. In explaining the cause of this irregular wear it is necessary to bear in mind that there are two ways in which driving wheels are slipped. First, when the slipping is slight but distinctly noticeable, extending through but a small portion of a revolution; and, second, when the hold on the rail is entirely broken and the wheels slip through a number of revolutions, usually turning with considerable velocity. There may a third in which the wheels slip imperceptibly, but of this I have seen no satisfactory proof, but, on the contrary, considerable evidence that it does not exist.

Let us consider the first case, when slipping is slight. This occurs almost without exception on heavy pulls at slow speed, being often seen when the engine is pulling hard on a hill, with the engineer trying to use sand sparingly, but alert "to catch her" at the first indication of "letting go." The beginning of slip must occur under these conditions at or near a maximum of the coefficient of slip. Referring to diagrams 1 and 2 we find a maximum value of the coefficient of slip a 50 deg. and 140 deg. at 10 miles per hour, and at 40 deg. and 160 deg. at 20 miles per hour. A slight slip here would cause a spot to wear following these points which the diagram shows. It is also noticeable that the amount of wear following 160 deg. is much greater than that following 40 deg. In the former case the weight on rail is rapidly increasing, in the latter diminishing.

The effects of the second case of slipping are shown by the long worn spot, connecting the spots last considered. When the slipping occurs at speed, or the wheels let go and spin with considerable velocity, the variation of weight upon the rail should cause the greatest wear in that portion of the tire under greatest pressure. At 30 and 40 miles an hour the pressure on the rail from 160 deg. to 30 deg. varies from 12,000 to nearly 19,000 lbs., while from 30 deg. to 160 deg. it never exceeds 13,000 lbs., and falls at 90 deg. to 100 deg. to nearly 9,000 lbs. The latter point is the least worn part of the tire.

As of course both wheels must slip together, the question may be asked, are there corresponding spots to these on the left tires one quarter back? Now, 90 deg. back of 40 deg. is 310 deg., and on the left, front and back wheels at this point can be seen a slight spot. It is nearly worn out or merged into the long spot through this point, due to slipping at speed. Then, again, 90 deg. back of 140 deg. is 50 deg., and here a decided spot is found on both left, front and back wheels.

With the main wheels the reasoning is the same, but as these wheels are underbalanced, the conditions are quite different from those found for front and back wheels. The spots caused by slight slipping near 40 deg. and 140 deg. should be found in these wheels as in the others, unless the accompanying condition of necessary pressure is absent. We find from 16,000 to 17,000 lbs. at the former point, and from 14,000 to 15,500 at the latter. This is an ample pressure to produce abrasion, and an examination of diagram 5 shows decided spots near 40 deg., and lighter ones near 140 deg. Again, the pressure is found to be greatest in these wheels between 10 deg. and 120 deg., where quite a decided spot is found. The wear of the tire on this pair of wheels is also modified by the pressure on the rail due to the angularity of the main rod, which attains the maximum at 90 deg. and 270 deg., and materially affects the wear at the latter point, near which, on account of these wheels being underbalanced, the wear would otherwise be slightest.

The conclusion arrived at by Mr. Barr that pressures not exceeding 11,000 lbs. produce but little abrasion is confirmed by my observations and the data herein shown. In conclusion, to reduce the irregular wear of tires to a minimum: 1. The weight of reciprocating parts and consequently the overbalance in the driving wheels should be as light as possible. 2. As small a proportion of the reciprocating parts should be balanced as is consistent with smooth working machinery and good riding qualities. 3. Have a careful man at the throttle.

Twenty-fifth Convention of the Master Car Builders' Association.

The twenty-fifth annual convention of the Master Car Builders' Association was called to order in the ball room of Congress Hall, Saratoga Springs, by the President, Mr. John Kirby, Superintendent of the Car Department of the Lake Shore & Michigan Southern, on Wednesday, June 15, at 10:30 A. M. Mr. C. W. Mitchell, the President of the village, welcomed the Association. After the roll call, the result of which was not announced, it was moved that the minutes of the last meeting be accepted and ordered printed without reading.

The President in his address referred in fitting terms to the death of Messrs. C. E. Gore, William F. Terriff, and Ross Kell, and said: "Since our last annual convention great progress has been made in the use of safety appliances for freight trains, and the record that has been made demonstrates that legislation either State or National would tend more to retard than to accelerate this movement." The President also referred to the probability of the Fox solid pressed steel truck demanding considerable attention during the coming year, and called attention to the necessity for an exceedingly careful consideration of the several clauses in the rules of interchange pertaining to the repairs to foreign cars chargeable to the owners.

The Secretary's report was then read. It showed that the total membership in October, 1891, was as follows: Active, 163; representive, 114; associate, 7; total, 284; since then six railroad companies have appointed representatives and resignations and deaths of members have changed the number so that the membership is now as follows: Active, 171; representative, 120; associate, 7; total, 298. The cars represented by the Association at the present time number 1,071,219, of which there are 11,570 not heretofore represented. The total increase of old and new roads in car representation is, as compiled from the latest returns, 79,655. The cash collected by the Secretary since the last report and up to June 14 was $7,191.79. The disbursements during the same period were $7,191.79, there being now no funds in the hands of the Secretary. The Association has no debts except some small bills for printing the reports for the present convention. The arrears of unpaid dues are $380.

The Treasurer reported a balance in the treasury to date of $4,841.07.

The dues for the coming year were fixed at $5 a vote. The President appointed the following committee for nominating officers for the ensuing year: F. D. Adams, J. M. Wallace, C. A. Smith, E. D. Bronner, R. D. Waitt; also he appointed as the Committee on Subjects for the ensuing year to report on Friday morning: Joseph Townsend, M. M. Martin, Pulaski Leeds and E. B. Wall, and as the Committee on Correspondence and Resolutions: R. H. Soule and W. H. Day; also an obituary committee on the death of E. E. Gore, John Voorhees and A. R. McAlpine; and on the death of Mr. William Turreff, William Garstang and John S. Lentz, and on the death of Mr. Ross Kells, John Mackenzie and F. B. Griffith. E. D. Nelson, C. A. Schroyer and Robert Walker were elected the Auditing Committee.

The Secretary then gave an account of the work of the Executive Committee pertaining to the Standard Coupler Gauges, and exhibited a gauge made according to the standard contour, a description of which and an illustration has been given in these columns before. The Secretary read a letter from the Pratt & Whitney Company, the makers of the standard gauge, stating that 50 gauges had been made and 32 delivered, and there are 13 now fully complete and ready for delivery. The Secretary then read the following letter from the Secretary of the Inter-State Commerce Commission, dated Washington, June 13, 1892:

To the Secretary of Master Car Builders' Association:

DEAR SIR: Yours of the 8th inst., in which you invite the Commission to be represented at your convention to be held at Saratoga Springs, N. Y., commencing on the 15th inst., has been received. The Commission appreciates the courtesy of this invitation and recognizes fully the importance of your Association, and the valuable results which have followed upon the discussion and the action taken from time to time in your annual conventions. The Commission is particularly impressed with the great value of your association in the line of perfecting and introducing into general and uniform use, so far as possible, those devices and appliances intended for the protection and for the security of human life and limb, especially the lives and limbs of railroad employés, now constituting so large a class, and among whom casualties have unhappily been so frequent.

It is with much regret, therefore, that I have to state to you that the Commission, owing to official engagements that cannot be deferred without putting complainants and others to great inconvenience and expense, will be unable on this occasion to attend your convention. Your work has, however, the warmest sympathy of the Commission, and I am sure will, so far as in its power lies, receive its cordial support and co-operation. EDWARD A. MOSELEY,
Secretary.

On motion of Mr. Lewis the letter was received and ordered to be embodied in the report of the proceedings of this meeting.

The report of the Committee on Joint Inspection was then read and action deferred until the rules of interchange are considered. It was then noted that the expenses of the members of the Arbitration and Executive Committee, when engaged in performing the duties of the association, shall be paid by the association.

Mr. James McGee (Houston & Texas Central) here introduced a topical question, asking whether, in case of the destruction of cars having trucks two years old and a body six years old, the depreciation of the truck and the body was to be based upon the age of the body or the age of the trucks. After considerable discussion it was decided by a vote of the association that "it is the sense of this association that the value of bodies and trucks destroyed shall be determined by the respective age of the bodies and trucks."

AFTERNOON SESSION.

The report of the committee on Air Brake and Signal Instructions was read by E. W. Grieves, Chairman.

The report will be given in these columns after it is finally passed upon by the association.

Mr. Godfrey W. Rhodes (C., B. & Q.) after calling attention to the evils resulting from a wide variation in piston travel, offered the following resolution: "Wherever the 4-in. piston travel is named in the report that it be changed to 6 in." Mr. J. N. Barr (C. M. & St. P.) indorsed this resolution. Mr. T. R. Bissell (Wagner Palace Car Company) was of the opinion that more cars would be found in service with 10 in. piston travels than with anything less. Mr. C. A. Schroyer (C. & N. W.) asked for 3 in. variation between the maximum and the minimum, thus making the minimum 6 in. and the maximum 9 in. Mr. J. W. Marden (Fitchburg) agreed with Mr. Schroyer.

Mr. R. H. Soule (Norfolk & Western) offered the following amendments to Mr. Rhodes' resolution: "That wherever mention is made in this report fixing the maximum or the minimum piston travel on air brakes, that it be changed to read that the minimum shall be 6 in. and the maximum travel 8 in." The amendment was accepted by Mr. Rhodes.

Mr. A. M. Waitt (L. S. & M. S.) called attention to the wide variation of the piston travel on cars having the brake beams hung above the truck springs, which variation was found frequently to be as much as 2 in. between loaded and unloaded cars, therefore it was his opinion that the recommendation of the committee namely, 4 in. as a minimum and 8 in. as a maximum, should be adopted in preference to limits giving a less variation.

Mr. Soule's amendment to Mr. Rhodes' resolution was finally carried after some discussion about details by various members and several explanations by the Committee and others of what was meant by the report of the Committee, by a vote of 32 to 28.

A resolution was made by Mr. Waitt, modified by Mr. Casanave and seconded by Mr. Leeds, to refer back to the Committee the paragraph in the report relating to the test for train pipe leakage on page 6 to be reported upon again at the Friday morning session.

Mr. Waitt called attention to the instructions on pages 9 and 10 calling for an examination of the brakes before starting down heavy grades, asking if it was intended that these instructions should be carried out. Mr. E. B. Wall moved that the words "before starting down heavy grades" be expunged from the instructions. This motion was seconded by Mr. Casanave. Mr. Pulaski Leeds then said: "I think that sentence should be left in. We have a grade of 217 ft. in a mile, and I think everybody after once coming down that hill would be for leaving this clause in. We have to use every brake we have and reverse the engine besides to get down the hill."

Mr. Waitt then explained that on the Lake Shore road there is a rule in force requiring an engineer to test the brakes on the entire train by applying them at least one mile before reaching a heavy down grade, which rule he thought would fill all requirements of inspection before going down heavy grades. He moved that a clause embodying such a rule be inserted in the instructions as amended by Mr. Wall's motion.

Mr. Roberts (Chicago & Grand Trunk) called attention to the fact that the instructions referred to "heavy grades," which was a term giving sufficient latitude to the instructions. If the grades were comparatively light, then the instructions did not have to be carried out, and if the grades were very heavy, then special instructions could be issued by any railroad company emphasizing the instructions printed in the report. The motion was then put with the result of a tie vote. The President then cast the decisive vote affirming Mr. Wall's resolution.

The Secretary, Mr. John W. Cloud, then made the following remarks, after which the vote was reconsidered, on motion of Mr. Waitt, seconded by Mr. Wall. After the Secretary's remarks the question was referred to the committee, to be reported upon for final action on Friday morning.

Mr. John W. Cloud's remarks.—I believe there is a misapprehension in this matter on the part of certain members and that the change which has just been decided upon has been under a misunderstanding. It is the practice on all heavy grade roads, where it is almost impossible to control the train except they have a brake on every car, to stop the train before descending and see that everything about the running gear is in order, and in doing so they want to know that the brakes are in order, just as they want to know that the locomotive is in order and able to pull the train up before ascending a grade. Now, the expression on page 10, "and before starting down heavy grades," was intended to apply to those very heavy grades, and any man here would be very willing and glad to do that if he ever went down one of those grades. It seems to me that the rule as it was proposed by the committee is very much better than the way you have now made it, simply because now it is impracticable. You cannot test a train running and tell anything about the brakes. It is said that this is required on every grade. I say, the railroad companies simply give instructions that on grades exceeding a given amount it is necessary to use the retaining valve in order to get down safer; and the rule is only intended to apply to such very heavy grades where it is important to know that everything is right before you start down.

After accepting an invitation extended by Mr. R. C Blackall, Superintendent of Motive Power of the Delaware & Hudson Canal Co., to an excursion to Lake George over that company's road on Saturday morning at nine o'clock, the convention adjourned, to meet at nine o'clock Thursday morning.

Fig. 1.—Machine Shop, from Gallery, showing 10-Ton Electric Crane and Supports for Shafting. Dynamo Room in Background.

Fig. 2.—General Interior View of Machine Shop looki

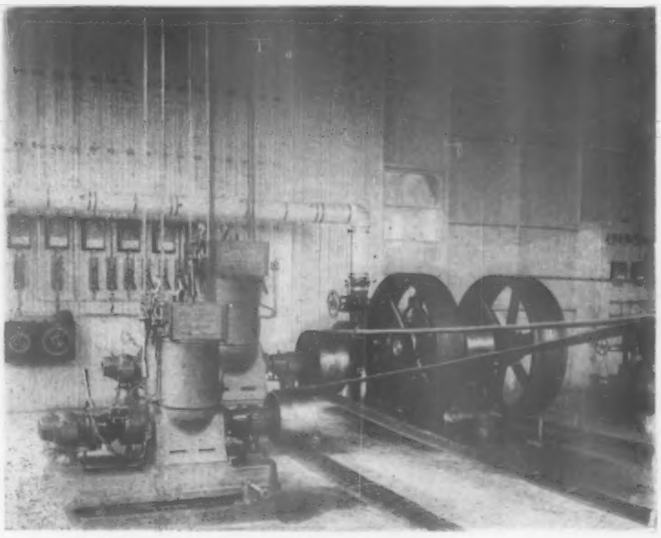


Fig. 4.—Dynamo Room.

Fig. 5.—Engine and Blowers, Sturtevant Heater System Shops, in Gallery.

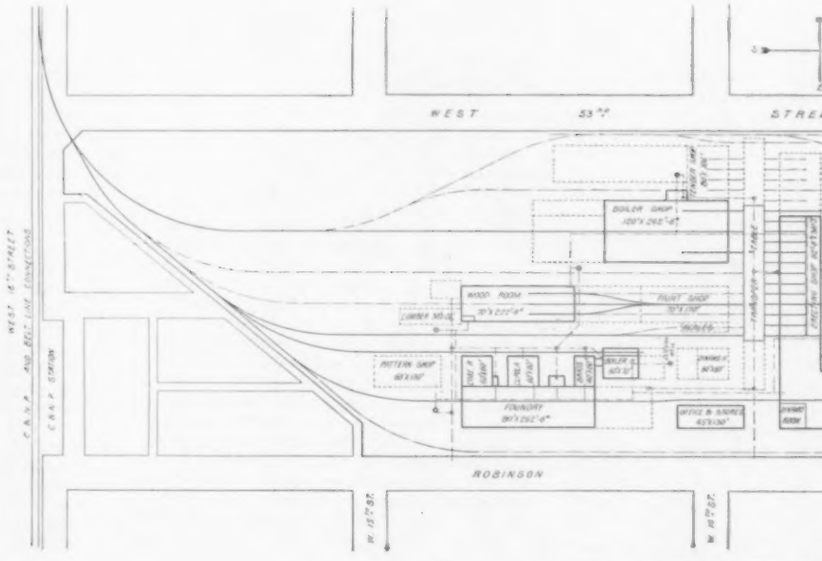


Fig. 7.—Plan of Tracks and B

GENERAL PLAN AND DETAIL VIEWS OF THE GRANT L

op looking North from Stairway.

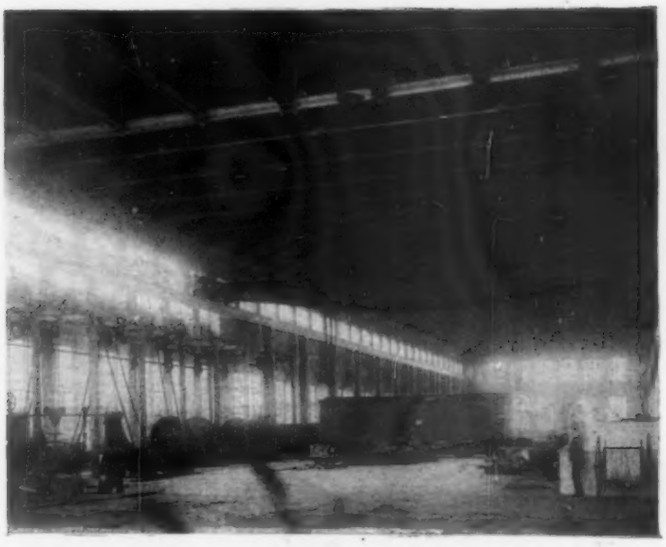


Fig. 3.—Forty-Ton Electric Crane and Wheel Lathes in Erecting Shop.

System, for Machine and Erecting
ry.

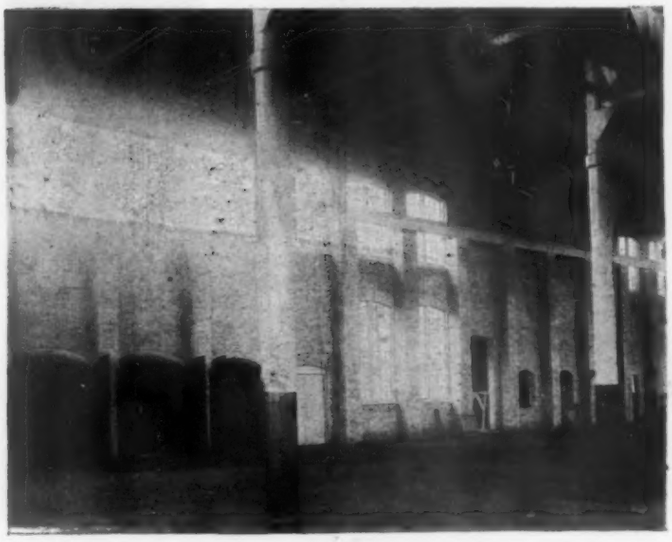
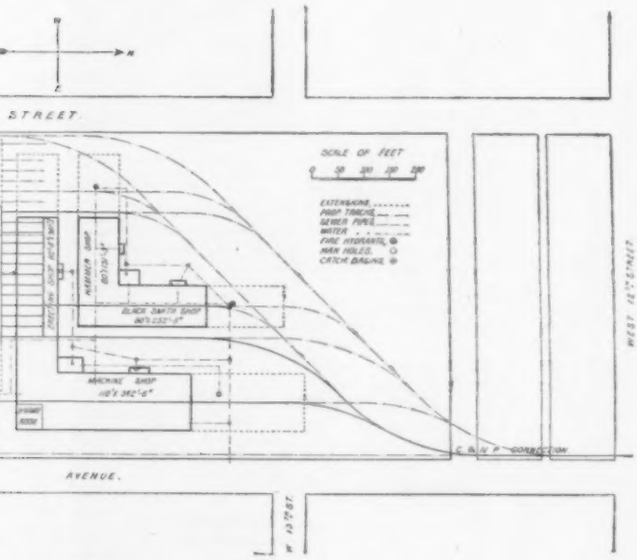


Fig. 6.—View in Foundry, showing Core Ovens. Cupolas below End of Crane.



s and Buildings.

RANT LOCOMOTIVE WORKS, CICERO, ILL.

The Grant Locomotive Works.

[WITH AN INSET.]

We give on an inset a number of illustrations of the Grant Locomotive Works, situated at Cicero, near Chicago, which will commence operations next week. The first work that the company will undertake will be to repair two engines for the "Alley" Elevated road and others for the Chicago & Western Indiana Belt Line and the Baltimore & Ohio. Order No. 1 is for the "Alley" road.

The buildings now completed are built so as to allow for future extensions. All the shops except the wood shop and proposed paint shops have electric overhead traveling cranes, in capacity ranging from 10 to 40 tons. The shops and the grounds are lighted wholly by electricity. Arc lamps are used for general illumination and incandescent lamps for the offices, machine shops and local lighting. The machinery for equipping these works is almost entirely new, only that machinery which was in first class condition was taken from the old shops at Paterson, N. J.

The grounds are supplied with complete and efficient water and sewerage systems. The water is taken from an artesian well, sunk upon the premises. The system for heating the buildings is as complete as any to be found in the West. All will be heated by exhaust steam from the various steam engines, distributed by the Sturtevant hot blast system. The blower, heater coils and the hot air conduits for the erecting and machine shop are shown in our illustration fig. 5. These heaters and blowers are placed in the gallery of the erecting shop. In the foundry the hot air conduit is placed underground and risers are led from it at suitable points for the distribution. In the erecting shop the main hot air conduit is a 5 ft. brick tunnel, having openings into each of the pits and three distributing risers spaced along the north wall of the shop. All other conduits are made of galvanized iron. This system insures perfect ventilation and an even temperature. The blowers are operated by individual engines directly connected. The machine and erecting shops are practically one. In the machine shop the machinery for light work is placed upon a gallery. Here are located the lighter lathes, planers, shapers, bolt and nut machines, etc. The machines for doing certain kinds of this light machine work are grouped and the groups separated by partitions. In the erecting shop are placed the wheel presses and boring and turning lathes for all classes of wheel work. This machinery, as well as the heavy radial and mill presses and some large planers (see figs. 1 and 3) are placed under the traveling cranes, near the walls. This necessitates hanging the main and counter shafting from a series of wooden stringers, supported at one end by upright posts and by the wall at the other. This arrangement permits the handling of the heavy castings and forgings for these machines by the crane, and also gives much valuable space for doing heavy machine work.

Fig. 1 is a view of the east side of the machine shop taken from the extreme north end of the gallery. The 10-ton crane and the heavy machinery with the supports for the shafting are clearly shown. The dynamo room is shown in the background. Fig. 3 is an interior view of the erecting shop, and shows the grouping of the wheel machinery, and also the 40 ton double lift electric traveling crane. There are 12 pits in this shop spaced 20 ft. apart centre to centre. Fig. 6 is an interior view of the foundry showing core rooms and ovens, cupola room and the electric crane.

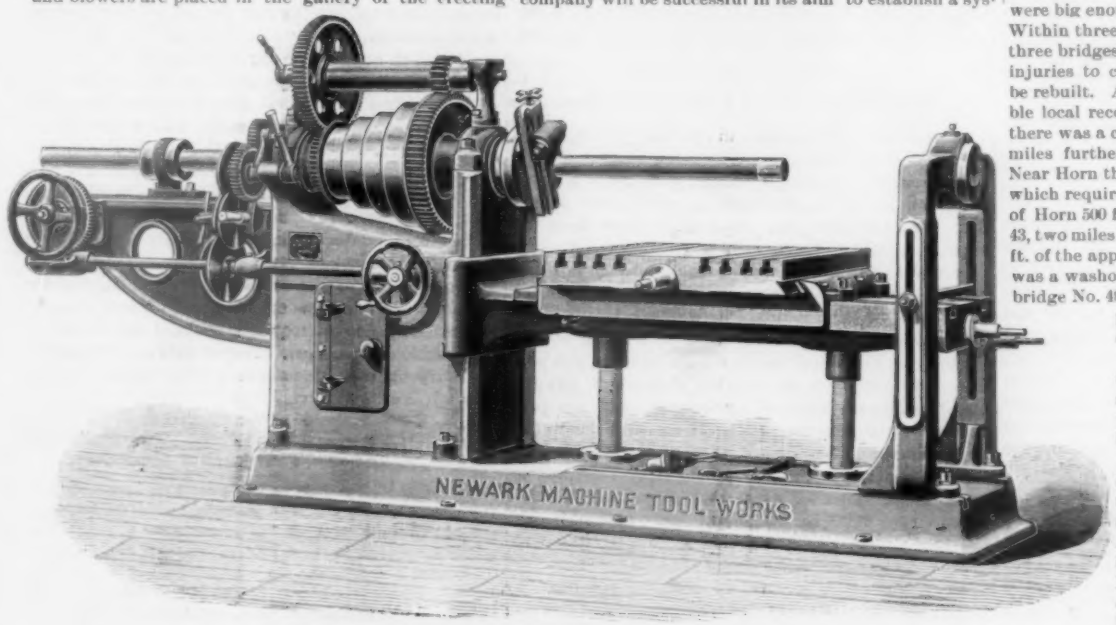
In the boiler shop there is a very large steam roll, but the other machinery is yet to be placed in this building. This shop is heated in a similar manner to the others. The heating apparatus is placed on a platform suspended from the roof, and above the engines and machinery. Only a part of the wood shop is erected. The plan, fig. 7, shows the extension provided for.

The office building is now being built and will be ready for occupancy within two months. Fig. 4 is a very good interior view of the dynamo room, showing the "Ideal" engine, Edison dynamos and the switchboard. Two of the dynamos are for incandescent lights and one is an arc light dynamo. The Ideal engine supplies the power for all the dynamos.

The blacksmith and hammer shops are well equipped with the latest and most improved tools for doing heavy work. In the hammer shop are four large hammers and three furnaces. Coal will be used for fuel in all furnaces and forges. In the blacksmith shop there are three hammers for heavy smith work.

The coal track at the boiler-house is on an elevated trestle, so that coal can be cheaply unloaded from hopper cars. Sectional views of the machine and erecting shops were shown in the *Railroad Gazette* of May 1, 1891.

It is through the untiring efforts of the President, Mr. Wm. H. Fenner, that these shops are opened as early as this. Mr. Fenner was for many years at the Rhode Island Locomotive Works as Manager, and has had a long and varied experience in locomotive building. In the new enterprise at Chicago he has gathered around him a body of associates who are recognized as among the ablest men, in their fields, in this country. The first locomotive will be built this summer and the scope of the preparations thus far made indicates that the company will be successful in its aim to establish a system for manufacturing and repairing of locomotives that will give results of the highest grade.



HORIZONTAL BORING AND DRILLING MACHINE.

Horizontal Boring and Drilling Machine.

The cut shows the smallest size of the horizontal boring machines which are a specialty of the Newark Machine Tool Works, Newark, N. J. They are built in four sizes with 3, 4, 5 and 6 in. bars respectively, the carriages and tables being made to suit customers. The distinguishing feature of this tool is the friction feed, which gives a wide range of feeds, is reversible and can be changed or thrown out altogether, while the machine is in motion. It has been in use for about three years. Among other points of interest in the construction of this machine is the strong form of the yoke to brace the table; the double bushings in the yoke to prevent wear of the boring bar or arbor; the strong form of table which is not opened, as usual, to receive the saddle screw; the stiffened saddle, with its heavy flanges, and the convenient facing attachment, which can be bolted to the bar as well as to the face-plate. The following are the general dimensions of the 3-in. car machine shown in the illustration: Diameter of bar, 3 in.; length of table, 5 ft.; swing over carriage, 3 ft. 3 in.; diameter of large speed cone, 16 in.; width of step, 3½ in.; carriage, 30 in. square; length of machine over all, 10 ft. 9 in.; weight, 7,500 lbs. This machine is well adapted, also, for heavy, flat and face milling, and a power cross feed is, when desired, furnished for this purpose.

The Floods in Pennsylvania and Elsewhere.

The damage done to the railroads by the flood of water and burning oil in the vicinity of Titusville and Oil City on June 5 seems to have been little different in kind from that suffered by previous freshets, and one of the roads running into Oil City reports that the height of the water over its tracks was not so great as in one or two previous floods. The reports of the number of people killed, which, variously stated at from 150 to 300, were persistently repeated for several days, have been reduced, and the total is now given as less than 100. We give such particulars of railroad damage as we have been able to secure from reliable sources.

On the Dunkirk, Allegheny Valley & Pittsburgh the trouble began Saturday night with a washout 31 miles south of Dunkirk. At Irvineton, 30 miles further, the road was flooded and the track was badly damaged for the whole distance from there to Garland, 10 miles. At East Titusville the flood washed a great amount of débris on the track, so that the road was impassable for a distance of a mile for three days. The trains on this road ran as far as East Titusville on Monday and passenger traffic was fully resumed Tuesday night.

On the New York, Pennsylvania & Ohio the trouble was between Meadville and Corry, which are 40 miles apart. There were washed away one iron bridge 63 ft. long, four miles east of Meadville; one 20-ft. arch culvert, half a mile west of Corry, and one arch culvert and six smaller culverts between the two. The company had no buildings destroyed or damaged. The roadbed was washed out more or less in several places, probably aggregating a distance of about two miles. Traffic on this road was stopped about 12 o'clock Saturday night and was resumed at 11 o'clock Monday night.

On the Philadelphia & Erie traffic was suspended for about three days. The worst damage on this road was at Union City, where there was a big flood on Sunday evening, which, it is said, was partially caused by the breaking of a dam. The roadbed was washed out from 4 to 6 ft. deep for about 900 ft., and there was a great amount of rubbish on the tracks. There was little damage west of Union City except two washouts which, however, were big enough to require considerable time for repair. Within three miles east of Union City the abutments of three bridges were badly damaged and there were slight injuries to culverts. One 10-ft. stone arch will have to be rebuilt. At Colgrove there was, according to a reliable local record, a rainfall of 5.35 in. in five hours, and there was a considerable washout at this place. Three miles further east there were three other washouts. Near Horn there were three bad washouts, including one which required a long trestle 25 ft. high. Two miles east of Horn 500 ft. of riprap was washed away. Bridge No. 43, two miles further east, was badly undermined, and 40 ft. of the approach washed away. At Pittsfield there was a washout 600 ft. long, and one of the abutments of bridge No. 48, east of there, was entirely destroyed. The pier under a bridge at Irvineton was cracked and otherwise damaged.

Heavy rains did much damage in Montana June 11, 12 and 13. There were landslides between Helena and Butte and a washout at Elliston. The railroads were blocked by washouts in the vicinity of Missoula for two or three days. A Great Falls dispatch of the 11th reported that the Montana Central had been blocked between there and Helena for five days. In Arkansas the high water had abated but little as late as June 13. The Louisville, New Orleans & Texas suffered by new washouts near New Orleans on Sunday last. On Monday the general situation at New Orleans was as bad as at any time this season, new crevasses being reported daily. The Southern Pacific had to suspend traffic on a portion of its line.

The trains of the St. Louis, Keokuk & Northwestern were run over their own track to Burlington on June 14, for the first time in three weeks, the river having fallen low enough to permit it.

Baines' Improved Car Truck.

The cattle cars of the Lackawanna Live Stock Express running between New York City and Chicago are fitted with a novel truck made expressly for stock cars by the Baines' Car Truck Co., 23 Broad street, New York City. The truck is hung on cross springs and is supported in such a manner as to give an unusual freedom of movement, and is found to be an exceedingly easy riding truck. Some of these trucks have made 200,000 miles in three years with few repairs.

Cooke Locomotive Company's Compound.

The two-cylinder compound locomotive, built by the Cooke Works, is now being tested on the New York, Lake Erie & Western, between Port Jervis & Susquehanna.

New Pacific Mail Steamer.

The new Pacific Mail steamship "Peru" was launched June 11, from the shipyard of the Union Iron Works at San Francisco. She is a steel steamer, 350 ft. long, with triple expansion engines of 2,800 H. P., and is expected to attain a speed of 15 knots an hour. The Peru will be put in the China trade.

The St. Clair Tunnel.

The Sarnia *Sun* says: "There has been a vast amount of talk regarding ventilation in the St. Clair tunnel. No trouble has been experienced from lack of ventilation. There are a couple of blowers at each end and the capacity of each blower is about 10,000 cu. ft. of air per minute. The whole volume of air in the tunnel may be passed through the tunnel in 45 min. Crews are working eight hours, making three crews a day, and there is a demand from men at all times for positions on the tunnel route."

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.
Published Every Friday.
At 73 Broadway, New York.
The subscription price is $4.20 a year in North America, and $6.08 in foreign countries.

EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

American railroad men who would like to see something better than an ordinary uncolored lamp-flame used for giving enginemen the signal to run at high speed through busy yards at night will be pleased to learn that so important a road as the Midland of England, with its 40 million train-miles yearly, has adopted green for the "all clear" night signal. Englishmen seem to be satisfied to get along with two colors (though the Clearing House code prescribes three, red, green and white—green for caution), and the problems connected with this change are therefore less troublesome than they are in this country, as will be seen by the following extract from a letter written by a Midland officer:

"We are dispensing with the white light as a driver's fixed signal and using the red and green lights only, red being the danger signal and green the all right signal; but we are at present only adopting this arrangement when new signal boxes are provided, or when considerable alterations are made in the signals at existing signal boxes. When the arrangement has been adopted generally a white light on our line when shown upon a fixed post where a red or a green light should be seen, will be considered a danger signal, and treated accordingly. We are also dispensing with the use of the green back light, which has hitherto been used to indicate to the signalman when the signal obeys the lever, so as to prevent the possibility of a driver mistaking this back light as a signal for him to proceed, and arranging for all signals, the normal position of which is danger, to show a white back light to the signalman when at danger, and for the light to be obscured when at all right."

The Midland evidently uses red to indicate that a caution signal is "on." This will not find favor with American signal engineers, and it ought not to; but if that color can be successfully used over there for the two indications, that is good presumptive evidence that a purple signal (whose main fault is that at a distance it seems to be red) could be safely used for a caution signal here. However this may be, the extensive use of green for all clear on such a busy line will serve to test the theory that we cannot get along without white lights.

Probably a greater number of accurate observations have been made of the temperature of locomotive smokeboxes in the last two years than for the ten years preceding. This is a good sign, as it is one of the indications of a desire on the part of the railroad men to find out why locomotives are not more efficient. The temperatures have been generally taken by a pyrometer. This is by no means an accurate instrument, but its indications are generally true within 50 degrees, and therefore the records are accurate enough for preliminary investigations. It is now pretty clearly shown that with a short flue the temperature of the smokebox is higher than with a long flue; also that the greater the vacuum in the smokebox the higher the temperature. The range of temperature while an engine is working varies from about 300 degrees F., as the lowest, to 1,400 degrees F. as the highest. In some experiments the heat has been so great as to soften the brass tube of the pyrometer. In comparing the records of pyrometers in locomotive smokeboxes, the location of the several instruments must be carefully considered. The results of different tests often are not comparable, as the pyrometers have been located in different places. The highest readings will always be obtained when the pyrometer is put between the deflecting plate and the tube sheet, and the lowest when it is placed near the front end of the smokebox. What is sought is the temperature of the gases of combustion just after they leave the tubes, as that is the final heating surface over which those gases pass. After they have left the tubes the products of combustion can generally do no more useful work. In order that future observations may be of real value there should be some agreement on this matter of location. It would seem for various reasons that the proper place is between the deflecting plate and the tube sheet; preferably somewhat below the centre of the boiler in order to get an average of the current of gas flowing from the tubes. The pyrometer should be a long one and extend practically across the boiler. Speaking in a general way, the results so far obtained show that the temperature of locomotive smokeboxes is less in compound engines than in simple engines. Perhaps a fair average of the difference is 300° F. A marked difference is to be expected, as there is less vacuum in the smokebox due to the less powerful exhaust of the compound, and there is, in consequence, less coal burned per square foot of grate per hour. The velocity of the hot gases over the heating surfaces being generally less, more heat is extracted from them and they pass into the smokebox at a lower temperature.

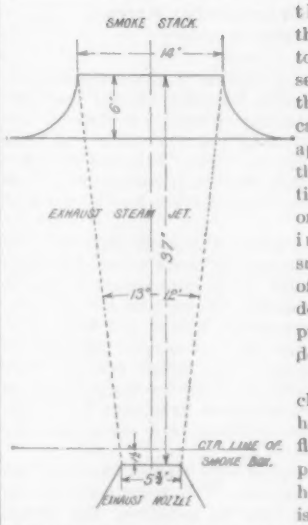
Common Sense About Exhaust Apparatus.

One cannot help thinking, in reading over the various discussions about exhaust nozzles, and the records of experiments made with them, that there is, after all, much lack of appreciation of well known principles of the action of jets. In a majority of cases the apparatus experimented with is constructed directly contrary to the experience of those who have made careful experiments with jets of liquids and gases for other purposes than to produce a vacuum in a locomotive smokebox. Almost any kind of a jet of steam, discharging into a pipe such as a smokestack, will produce something of a vacuum, but all kinds of jets discharging into all kinds of smokestacks will not produce the same vacuum. Probably the variation in the dimensions and location of the exhaust nozzle and stack necessary to produce the maximum vacuum is quite small. That is, when that arrangement is secured which will give the maximum vacuum, it will be found that a slight variation in the fixtures will make a decided difference in the vacuum.

As an illustration of what we mean we will recite a bit of experience recently had with a large and powerful locomotive that was working under difficulties and failed to make enough steam owing to lack of draft. We do not say that the changes which were made in the engine to produce the desired result were the best that could be made, or that the arrangement shown in our illustration is theoretically perfect; but the results were decidedly satisfactory.

A large 10-wheel engine was laboring with a poor quality of Illinois coal, the back pressure in the cylinders was considerable, the exhaust was powerful and made a great deal of noise, the vacuum in the smokebox was small and the fire burned badly. After experimenting with the grates and different methods of firing with no practical improvement, the man in charge looked into the smokebox and noticed that the steam jet did not touch the stack until it was nearly half way up to the top. Being of an experimental turn of mind, and possessed of a good degree of common sense, he made a *slight* (?) change in the arrangement by dropping the exhaust nozzle about 10 inches. Immediately there was a change in the vacuum, and instead of being too little there was decidedly too much. The fire was torn to pieces. The exhaust nozzle had been 4½ in. in diameter inside; under the new arrangement this was too small. It was changed to 5, then to 5¼, and finally to 5½ in., and even with this increase in size there was a large increase in the vacuum obtained.

The accompanying cut shows the dimensions and arrangement after the change. The angle of the sides of the exhaust jet was about 13 deg. 12 min., as nearly as could be estimated, but other experiments have shown this angle to be nearer to 15 deg. The top of the nozzle was lowered from 8 or 9 in. above the centre of the boiler to 1½ in. below, with the result that the jet from the exhaust nozzle filled the stack, as is shown in the cut, at a point near its base. The improvement found to result in operation is what might have been predicted. There is no mystery about the reasons for the good results, and no discovery has been made by



the experimenter that adds anything to knowledge possessed before. All that was done in this case was to put the apparatus into something like a true position to act as an ejector. With the increase in vacuum in the smokebox there was, of course, a decided decrease of back pressure in the cylinders.

In addition to the change of the exhaust nozzles, the deflecting plate was punched full of holes, somewhat as is done with the Bell spark arrester, with the result of making the fire burn more evenly. This change in the deflector did not, of course, tend to increase the vacuum, but only to distribute the action of the vacuum properly over the tubes. The drawing shows how simple is the arrangement to give quite satisfactory results, and it contrasts strongly with the complicated devices and mechanisms sometimes seen, where "rule of thumb" processes are employed to obtain a proper arrangement of exhaust apparatus. Before complicated devices are used it should be first shown that simple arrangements are inadequate. Three factors enter into this arrangement, namely, the diameter of the stack, diameter of the exhaust nozzles, and the relative position of the top of the nozzle to the bottom of the stack. It is highly probable that a judicious arrangement of these factors will produce what is generally sought for in the way of a smokebox vacuum, accompanied with a reasonable back pressure in the cylinders. Most of the complicated devices and curious combinations of smoke box mechanisms so frequently offered deserve to be very cautiously received. They should in every case be made to prove their claims before being asked to "make themselves at home."

Locomotive Cylinder Power Consumed Ahead of First Car.

One of the most interesting points of investigation, and in fact almost the objective point with engineers of test of railroads, is that of determining that part of the power generated in the cylinders which is consumed by the engine and tender. To haul a locomotive and tender over a railroad is not useful work, and it is not strictly useful to haul the dead weight of cars, but both the locomotive, its tender and the car bodies are indispensable, and all that can be done to increase the proportion of useful work is to reduce the dead weight and the resistance as much as we can. The really useful load is the paying freight, but it is customary when making locomotive tests to assume that the load back of the tender is the useful load, and recent investigations have had for their object the determination of the per cent. of work done on the train back of the tender, a dynamometer car being used for the measurements. In this way it has been frequently found that a locomotive and tender consumed more than one-half of the power generated. In one case it was found to be as high as 70 per cent. When this result was first made known it occasioned considerable surprise, as few people believed that more than one-half of the coal burned was used to propel the engine and tender. In the case in point it was shown that the weight of the locomotive and its tender, loaded, was about 60 per cent. of the total train weight, and it was quickly seen why there was more than 60 per cent. of the power used ahead of the first car.

Not long since a writer in an engineering journal announced the conclusion, which he assumed to be a useful one, that at 75 miles an hour a locomotive and tender would necessarily, owing to the internal friction and the head air resistance, consume 80 per cent. or more of the power generated in the cylinders and that at some higher speeds a still greater percentage of all of the power would be consumed ahead of the first car. Such a conclusion, while true, within limits, for very high speeds is misleading, because one might suppose that at high speed a locomotive would necessarily lack capacity to haul trains, solely because of its internal friction and the head air resistance. This is not a safe general conclusion unless it is modified by assuming a down grade or a level track and extraodinarily high speeds, and even then is not safe if it conveys the impression that the lack of capacity at high speed is a necessity and cannot be largely removed by changes in design.

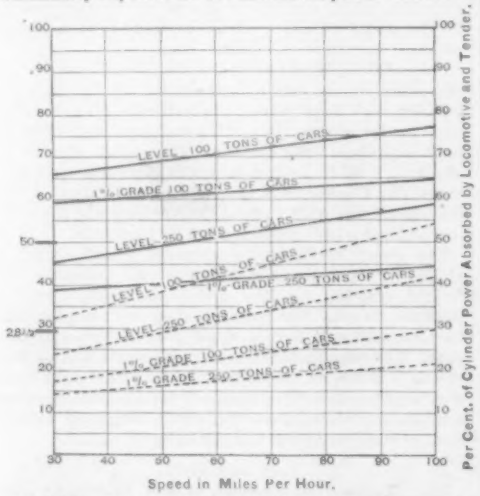
The resistance of a railroad train for our present purpose may be summed up as follows: Frictional resistance of cars back of the tender, including rolling, flange and journal friction, the friction of the air, and the very uncertain element of oscillation.

Practically the flange friction and the journal friction make up nearly all of the resistance back of the tender. If there be a side wind the flange friction will be the major part of the whole. Without a side wind, the journal friction is the greater. The exact proportion is variable and its limits are unknown, but probably the journal and flange friction make up about 90 per cent. of all the resistance back of the tender. The second subdivision of the train resistance may be taken as the journal and flange friction of the locomotive. The third the head air resistance encountered by the engine. The fourth the internal friction of the engine, not including the friction of the axle journals. Some of these factors are more variable than others. For instance, the head air resistance varies with the velocity, and for the purpose of approximate estimates it may be assumed to vary directly with the velocity; that is, twice the velocity will give twice the air pressure. The journal and flange friction of the locomotive and tender is probably less in pounds per ton of total weight than that of the cars owing to the greater load on the journals and the greater concentration of the mass; but for the purpose of an approximate estimate it may be taken as being the same in pounds per ton as for the cars.

The internal resistance of the engine is made up of several factors, some of which are constant and others variable. For instance, the friction of the stuffing boxes is perhaps the same at high speeds as at low; at least there is probably not much difference. The friction of the slide valves is probably less at high speeds owing to the reduction of the pressure on them caused by the increase of back pressure under the valve. The friction of the crossheads and connecting rods will probably be less at high speeds owing to the smaller pressure on them. The mean effective pressure in the cylinder is almost always less at high speeds. The friction of the piston will depend somewhat upon the pressure of the steam in the cylinders and may be less at high speeds.

While, therefore, we cannot say just what is the friction of the mechanism of a locomotive at any particular speed, we may for our present purpose safely reason that it does not materially change as the speed changes, our present purpose being the illustration of the effect of grade and the effect of the dead weight of a locomotive and tender on the percentage of power absorbed ahead of the first car. We have assumed that the friction does not materially change as the speed changes, but if the pressure on the working parts changes, the friction changes also, and therefore as a basis for an estimate it is perhaps nearer right to assume that the internal friction of the engine is some constant per cent. of the total power generated in the cylinders. As we are now speaking of some statements to the effect that a locomotive generally consumes a larger percentage of power than might be reasonably expected of it, it is better to err on the safe side and assume the internal friction of the engine at a pretty high figure. Therefore, let it be taken at 10 per cent. of the total force generated, this is certainly high enough.

The diagram shows the results of some calculations made from such data as we have assumed in this brief speculation. The different lines show what should be reasonably expected as the amount of power consumed



Full lines show approximately the per cent. of power absorbed by the total resistance of locomotive and tender. Dotted lines show approximately the per cent. of power absorbed by the internal friction and head air resistance of locomotive.

by the engine and tender in percentage of the whole power generated at various speeds. The frictional resistance of the train in pounds per ton is assumed to be uniformly 8 lbs., but it is generally less than this as soon as the bearings are warmed up after service, and almost always less than this at high speeds. The internal resistance of the engine is assumed at 10 per cent. of the total resistance of the train. The weight of the tender is taken at 40 tons, the engine at 60 tons, and the train at 250 and 100 tons. The area of a front of a train or locomotive does not vary much from 100 sq. ft., and owing to the peculiar shape of the front end it is doubtful if the effective area is as much as that; but for the purpose of this argument we may assume 100 sq. ft. From experiments made by Mr. O. T. Crosby, the pressure on 5 sq. ft. at different velocities has been determined approximately. There are indications, however, that Mr. Crosby's results are too high for large area.

On the foregoing basis the diagram shows the per cent. of total power generated in the cylinder that is consumed by the engine and tender on a level and on a 1 per cent. grade when hauling 100-ton and 250-ton trains. The dotted lines on the diagram show the per cent. of power absorbed by the internal friction and by the head air pressure taken together, and not including the axle journal friction of the engine. The full lines show the per cent. of power absorbed by all of the combined resistances of the engine and tender. The locomotive and tender are in weight 50 per cent of the total train weight in one case and 28½ per cent. in the other.

It is noticeable from the diagram that on a grade our estimated per cent. of power consumed by the engine and tender is more nearly constant. This is reasonable, for with a very sharp grade the resistance due to friction and air pressure will be small compared to the resistance due to the grade; and each ton in the total load, whether of locomotive or cars, would then offer about an equal resistance, and the per cent. of power necessary to propel the engine up the grade would be about the same as the ratio of the weight of the engine and tender to the weight of the total train, and therefore nearly constant. On the other hand, on a descending grade the resistance is made up largely of the head air pressure and the internal friction of the engine, a condition under which almost the entire power generated in the cylinders would be consumed by the engine alone, not including the tender.

The diagram shows approximately how the resistance of a 100-ton and a 250-ton train is distributed between the cars and the engine on a level and on a 1 per cent. grade, and from these estimates it is clear that any statement to the effect that the internal friction and the head air resistance consumes a large percentage of all of the power generated in the cylinders is inaccurate and misleading, unless the statement is accompanied by an explanation of all the conditions under which the engine is running, more particularly with reference to the grade and train weight. In general a steam locomotive will consume a larger percentage of the power on a level than on a grade, and it may consume all of the power on a sharp down grade. Also heavy engines and tenders with the same train will consume a greater percentage of all the power generated than lighter ones. Therefore we may conclude that it is not safe to accept statements about the percentage of power consumed by the engine and tender unless they are accompanied by explanations of the relative weights of the locomotive, its tender and the train and the prevailing conditions.

It may be well to add that at high speed, as has been explained in these columns (issue of March 18, 1892) there is a lack of actual force or mean effective pressure in the cylinders to accelerate the train to higher velocities, and that the mean effective pressure is affected greatly by improvements in the valve gear and steam passages, all of which go to show the reasons for the greater hauling power at high speeds of some comparatively light engines. The difference in the hauling capacity at high speed results from differences in the parts governing the use of the steam, there being almost always sufficient weight on the drivers to furnish the necessary adhesion at high speeds. All this is well exemplified by the success of the Reading fast passenger engines in which have been used, what some people term, extraordinary measures to get more power in the cylinders. The designer of these engines has given ¼-in. inside clearance for the slide valves, reduced the compression and back pressure, and increased the valve travel to 7 in. with 1¼ in. outside lap, all this to improve the steam admission."

The conclusion to be drawn from this is, that to reduce the percentage of power consumed by the engine and tender at high speed there should be more power generated in the cylinders in proportion to the weight of the engine, in order that heavier trains may be hauled by the same engine. This could be done by increasing the main effective pressure in the cylinders. Also, there should be a decrease in the dead weight of the engine and tender. The result of such changes is always to give the power necessary to haul a heavier proportionate train, which results finally in a less proportion of the whole power generated that is consumed ahead of the first car.

By the introduction of electric motors the amount of dead weight to be carried will be materially decreased, as no tender will be required. Assuming that the electric locomotive will weigh the same as the steam engine without the tender, or say 60 tons with the same total weight of train or 350 tons, there would be possible an increase in the useful load of 16 per cent.

The Westinghouse Air Brake on the Chicago Elevated.

Up to the opening of the Chicago & South Side (Alley) elevated road in Chicago last week, there was in some quarters considerable doubt as to the adaptability of the Westinghouse brake for elevated railroad service. It was thought that the release would not be quick enough and the pump would be overtaxed. Now, after one week's experience, the special value of a compressed air brake for frequent stops is so fully proved that all doubt has been removed, and all concerned with the road are more than pleased with its operation.

The release is practically instantaneous; the brakes can be applied and let off at least three times during an ordinary stop if desired. The pump is not working up to one-third of its capacity and it makes little or no noise. The exhaust of the pump and triple valves is muffled; and, taken altogether, the new departure in braking on elevated roads is a decided success.

The reasons for using this brake on the Chicago elevated are many. Among the more important ones are the greater safety of trains having an emergency automatic brake; the greater average speed over the line resulting from a quicker stop; the easier stopping of cars and reduced effect on passengers which results from the forcible application of brakes at the higher speeds instead of a great increase of the braking power toward the end of the stop; the control given to the gatemen by the conductor's valves on each car, so that if a passenger is being jammed the gateman can apply the brakes instantly without signaling to the engine; the reduced strain on the structure arising from the more even distribution of the braking power during the whole stop instead of a forcible application toward the end of the stop.

One of the most striking results of the use of the air brake is in the greater certainty of stopping at a given point. Those of the enginemen who have become used to the road now make a majority of the stops with *one application*, those least familiar only make three, successive, light applications. This contrasts strongly with the handling of the brake on the Manhattan elevated, where from three to seven applications are made to reduce the speed from 30 miles an hour. Of course the reason is obvious; there is a much more perfect control of the brakes by the engineman in the case of the compressed air brake. It was expected that there would be some trouble in getting the runners to stop their trains at the targets placed where the engine should stop, but on the contrary it has been found quite easy to stop at any point desired without hauling out or backing up, or, what is more objectionable, a sudden increased application of the brakes at the end of a stop to prevent passing the target.

From this success of the Westinghouse Air Brake Co. it will probably result that all future elevated roads in Chicago will be compelled by city ordinance to use a compressed air brake having the automatic and emergency features.

The acquisition of the Housatonic railroad and its leased lines, about 192 miles, by the New York, New Haven & Hartford, seems to be an accomplished fact. This, with the New York, Providence & Boston, which has just been leased, will give the New Haven people a system of about 850 miles, and they will practically control the railroads throughout Connecticut, most of Rhode Island and all of Massachusetts south of the Boston & Albany as far east as Worcester, with the exception of three lines, the New London Northern, the Central New England & Western and the New York & New England. It is certainly in the interest of economical and efficient management for this large road to absorb the Housatonic so, if the company gives first quality service—which it undoubtedly knows how to do—and at fair rates no one should complain. Moreover, the public will feel a decided relief to be rid of the unseemly controversies between the companies which have been carried on, by one side at least, in what the New York *Evening Post* would call ruffianly ways. At New Haven and Bridgeport, particularly the latter, the amalgamation of interests will save large unnecessary expenditures. A new station and an elevated line are badly needed at Bridgeport. The recent talk of securing an entrance for the Housatonic and the New York & New England into New York city (except by the water route from Wilson's Point, which is already running) had little or no foundation worth noticing; but the New Haven road seems to feel relieved at the removal of that possible danger, nevertheless, for it is already given out that more active steps are to be taken to improve the New York division. Probably the men most interested regard this transfer of the Housatonic as of fully as much importance in its effect on the New York & New England as it is in itself. These two roads have been controlled in the same interest. The New Haven road probably desires to get the latter as much as it did the former, and as people will assume that the men who sold out one can sell out the other, they will expect to see still further conquests. The New England road is not so very much weakened, as a railroad, by the loss of the Housatonic, as the object most talked about in connection with the alliance—a profitable passenger line from Boston to New York—would have been practically unattainable, but it is probably crippled as a "bluffer" in Wall street very seriously.

The methods adopted by the companies to comply with the New York State law regulating the hours of labor on railroads, which went into effect May 20, have already precipitated one strike—of yardmen on the New York Central at Lockport—and loud threats of another—on the Lehigh Valley at Buffalo. The law "shall not affect the mileage system," and it therefore makes no changes with trainmen, and even for yardmen, who have been working by the day the companies can, so far as the letter of the law is concerned, comply with it without inconvenience, as the requirement simply means that a man working extra time shall receive extra pay; and that has been the case all along. The trouble seems to

have arisen from the way in which the companies estimated the extra time. It appears that a man who had been working, say, 12 hours a day for $2.40 a day had his rate changed on May 21 to $2 a day (10 hours) and 40 cents extra for the two hours of constructive overtime. As the New York Central announced that no changes would be made in the amounts received by its men, it is to be concluded that the paymaster failed to rightly construe the orders or else that the Lockport men are scared before they are hurt. If the promoters of this law actually expected that it would shorten their hours or increase their pay they have blundered badly; but no worse than have the makers of most laws of this kind. In fact, many of the railroad laws of New York are notable chiefly as monuments of careless or foolish legislation.

As we go to press the news comes of the complete destruction of the false work of a span of a bridge erecting over the Licking River, between Covington and Newport, Ky. The span is about 360 ft. long, and perhaps half of it had been erected. All of the false work under this span, with the traveler and the erected material, went into the river. It is supposed now that 40 men lost their lives. Among those killed or drowned are Robert and Andrew Baird, contractors for erecting the superstructure. These well-known men, with their brother William Baird, have made a brilliant record for skill and capacity in bridge erecting, and have done some of the most important work of this kind that has been done in recent years. Their last great work was erecting the Memphis bridge. Whatever may have been the cause of the destruction of the Licking River false work, the contractors knew their business thoroughly. The bridge is building by the King Bridge Co., for the Kenton & Campbell County Land Co. It is a highway bridge with street car tracks.

The convention exhibits this year on the veranda and in the yards of Congress Hall, Saratoga, are unusually good and of a high order; there is a noticeable absence of cranks with astonishing car couplers and other devices. Excellent models and full-sized machines are in abundance. What remains of the numerous steam heating devices that exhibited two years ago are now represented with well developed systems. The car couplers are nearly all of the vertical plane type, well constructed and considerably improved. The pressed steel makers are out in force with good exhibits, and the makers of steam fittings, couplings, gauges, whistles and valves have unusually good displays. A list of the exhibits will be given next week, after the remainder of the devices have been received and put into position.

The Missouri Pacific Railway has devoted much attention to the subject of a proper steel for locomotive fireboxes, and in some specifications recently made for new engines to be built at the Baldwin Locomotive Works the tests specified for the firebox steel are very difficult to meet. The Wellman Iron & Steel Company undertook to meet the requirements, and as a result the firebox steel was found to contain only from .008 to .013 per cent. of phosphorus. The ultimate tensile strength averaged 48,000 lbs. per sq. in. The reduction of area in per cent. of original area averaged 68 per cent. The final elongation in per cent. of original length (which was 2 ins. between shoulders) was 48 per cent. This is a quality of steel that is especially well adapted for fireboxes as it is soft and ductile and low in phosphorus.

NEW PUBLICATIONS.

Valve Gears for Steam Engines. By Cecil H. Peabody, Associate Professor of Steam Engineering at the Mass. Inst. of Technology. New York: John Wiley & Sons. So many books on this subject have been published and there seems to be so little which is new to be said about valve gears, that at first glance there does not appear to be any sufficient reason for still further increasing the number of such books. The author states in the preface that: "This book is intended to give engineering students instruction in the theory and practice of designing valve gears for steam engines," and that: "In the presentation of the elementary principles, geometrical or analytical methods are used as necessity or convenience may suggest; but in the application, geometrical methods are used exclusively in conformity with the usual and preferable habit of laying out valve gears by construction. Zeuner's valve diagram is used because it is widely and favorably known and appears to the author to be at least as good as any other circular diagram."

The purposes of the work has been admirably carried out, with the result that in 126 pages of text Professor Peabody has given us the best practical, general treatise on valve gears which has as yet appeared. Of this about 16 pages are devoted to analytical discussions and the development of equations applicable to slide valve and link motions, while the remainder of the book, with its 33 plates containing about 100 figures, is given to clear, concise and accurate descriptions of various valve gears and the methods to be employed in practice in designing such gears.

About 50 pages are given to link motions. Starting with the Stephenson link motion, Zeuner's analytical discussion is developed by which the relations between motion from the link and from a single eccentric are shown, and the conditions for equal loads and the effects of open and crossed rods are demonstrated. Similar equations are developed for the Gooch link motion. In designing link motions the Zeuner diagram is used as a basis and the motion is finally laid down and adjusted by means of a skeleton model of simple construction. This method is certainly the best, if not the only practicable method of designing the best link motion for any given set of conditions. By a series of examples Professor Peabody shows the effects of changing the proportions in an illustrative case, such as increasing the length of eccentric rods, equalizing the cut-off at one-half in place of one-third stroke, shortening the link, placing the link pins on the link arc and placing them ahead of the link arc.

Under the head of Radial Valve-Gears the Walschaert, Marshall and Joy gears are illustrated and described. Following this is a chapter on double valve gears, such as the Meyer valve motion, and the concluding chapter consists of descriptions and an outline of the method of design of drop cut-off valve gears, including the Brown, Reynolds-Corliss, Putnam and Gaskill valve gears.

Altogether, Prof. Peabody has succeeded admirably in steering a middle course between theoretical equations from which the general effects of changes in proportions can be most readily seen, but which are of no other use in practical designing, and the so-called practical methods which are frequently excellent guides so long as customary proportions are followed, but are of little assistance when unusual proportions must be adopted. If any general criticism can be properly made upon this book, it is that it is too concise and condensed at times to be readily followed by the student. For class use this is comparatively a small matter as the instructor can emphasize the facts which he thinks the most important, but text-books should be so written that a fairly careful reader can grasp the salient points without difficulty.

The Zeuner diagram is, of course, the most widely known of all valve diagrams, which is probably a sufficient reason for adopting it in this book, but the newer Bilgram diagram has some advantages and as its use is readily acquired by anyone who is familiar with the Zeuner diagram, it would seem that some description of it should be found in such a treatise as the one before us.

The book is well indexed, the plates are conveniently arranged and clearly lettered, and we have noticed but very few typographical errors. While it is primarily intended for engineering students, we believe that there are but few designers who will not find it a valuable addition to their libraries.

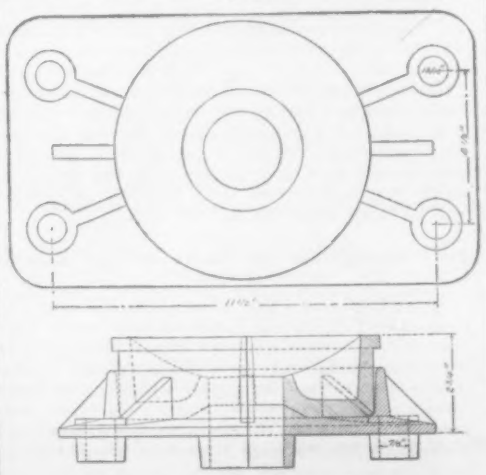
TRADE CATALOGUES.

Power Transmission by Manila Rope is the title of a pamphlet issued by the Link-Belt Engineering Company, of Philadelphia, describing the apparatus and devices of this company for the purpose indicated. Various points of superiority over leather belting are set forth. Illustrations and numerous examples are given of transmission of power long distances vertically and where sharp corners have to be turned at varying angles. This company has designed a multiple-groove sheave which is very light and strong.

Thomas Carlin's Sons, Allegheny, Pa., have issued a catalogue of nearly 200 pages illustrating and describing the great variety of contractors' tools and machinery, brick-making plants and rolling-mill machinery manufactured by the firm. A glance at the illustrations and the index gives the idea that it would be easier to tell what the catalogue does not contain than to satisfactorily describe its varied contents.

A New Malleable Iron Centre Plate.

The National Malleable Castings Co. have designed a new malleable iron centre plate believed to embody all of the latest improvements in centre plate and superior to any yet proposed. It is shown in the engraving and differs from that proposed by the M. B. C. committee on "Centre Plates and Stake Pockets" mainly in the greater bearing of the king bolt. The illustration shows the construction. The advantages claimed for it are: Interchangeability in all important features with the proposed standard; large bearing for all bolts and provision for receiving lugs into the truck bolster to prevent shifting and shearing of bolts; such increased area for the king bolt as to prevent rearing of that bolt and knocking of the truck from under the car in any reasonable service; provision for holding oil between the plates; reduced weight and cost.



Body Centre Plate for Wooden Bolsters.

TECHNICAL.

Manufacturing and Business.

L. H. Spilman has been appointed Receiver of the Knoxville Car Wheel Co., of Knoxville, Tenn.

The capital stock of the Shelby Steel Tube Co., of Shelby, O., has been increased from $100,000 to $200,000.

The Niles Tool Works, of Hamilton, O., has been changed into an incorporated company under the name of the Niles Tool Works Co., with a capital stock of $1,000,000.

The Lidgerwood Mfg. Co., of New York, makers of hoisting engines and cable ways, exceeded all previous records of monthly sales during May, having shipped in that month 127 engines and 45 boilers, an average of five engines a day.

The Westinghouse Machine Co., of Pittsburgh, is building a new brick addition, 50 × 265 ft., to the assembling and erecting shop. The new building will displace the old erecting shop, which was 30 × 265 ft. It will be lighted by means of 3,000 sq. ft. of skylight and will be equipped with two 10-ton power cranes.

The Jones Vestibule Sleeping Car Co., which was organized at Denver about three months ago, has recently purchased 50 acres of land within six miles of the city limits. The officers state that work will soon begin on the proposed car shops, but the first cars under the company's patents will be built in the East. The officers are: H. A. W. Tabor, President; Nathan A. Baker, Vice-President; H. M. Jones (patentee), General Manager, and E. W. Sebben, Assistant General Manager.

New Stations and Shops.

The Northern Pacific Terminal Co. has begun the construction of a 20-stall roundhouse for the Northern Pacific at Portland, Or., and will soon begin to erect a new freight house, 800 ft. long, on Seventh street.

Extensive improvements have been begun at the Mt. Clare shops of the Baltimore & Ohio, which will facilitate the repair work that is constantly going on. Workmen are now building a new repair shop, and when it is completed will begin the erection of a large storehouse for supplies. The stock constantly on hand is valued at $1,000.

The contractors say that the extensive shops of the Norfolk & Western road going up at Lambert's Point, near Norfolk, Va., will be fully completed within five weeks. The machine shops are 80 × 100 ft., the repair shop 75 × 380 ft., and the dwellings for the workmen are rapidly going up, and will be occupied as soon as completed.

Samuel F. Hodge & Co., of Detroit, Mich., have adopted the plans of the Berlin Iron Bridge Co. for their new foundry, and have placed the contract with that company for the construction of the building, which will be built entirely of brick and iron. The general dimensions are 86 ft. × 161 ft., and on each side there is a wing 23 ft. in width. The centre of the building is controlled by a traveling crane with a travel the full length of the building, and the wings are controlled by jib cranes.

The Great Northern has prepared plans for machine shops, car repair shops, roundhouse and passenger and freight stations for the divisional headquarters at Spokane, Wash. The machine shop will employ over 250 men, and will have a capacity of 75 locomotives a year. The roundhouse is to have 40 stalls, and at least one half of this will be built at once. The freight house will be of brick, but the material for the passenger station has not yet been selected. It is expected to have most of these buildings completed by December.

Iron and Steel.

The Bessemer department of the Worcester Steel Works, at Worcester, Mass., has been sold to the Indiana Steel Co., of Indianapolis, Ind., and the machinery will be removed to the latter city.

The plant of the Midland Steel Co., at Muncie, Ind., is nearing completion, and the company will probably commence operations in a few weeks, employing about 200 men. Considerable of the machinery being put in this plant is being furnished by the Totten & Hogg Iron & Steel Foundry Co., Pittsburg.

The Moran Flexible Metallic Steam Connection. The double bogie locomotive built by the Baldwin Locomotive works for the Sinnemahoning Valley Railroad, and illustrated in the *Railroad Gazette* of May 13, 1892, has a particularly novel feature in the flexible steam connection. The connection is what is known as the Moran Flexible Steam Joint, which is wholly metallic. The adoption of that joint for such important locomotive work is an evidence of great confidence in it. Of course this joint is not new and is not an experiment, as

it has been used for a long time for a steam connection between locomotive tenders and baggage cars on the Pennsylvania and the Chesapeake & Ohio railroad. The Standard Oil Company took up this joint first for various oil connections under heavy pressures, and used it also in the pipe line from Oil City to New York. At the Henry R. Worthington pump manufactory this connection is used in the testing department. The Ingersoll Sergeant Drill Co., uses it universally for flexible connections in drilling machinery.

The Harvey Steel Cars.

The shops of the Harvey Steel Car Co., of Chicago, are very busy, having more work than they can attend to in the line of car repairs. This company has been successful almost from the start. It has a number of steel cars now running which give good satisfaction, and it is offering to build steel underframes of the very best type for about $50 a car more than timber. This is the price in small orders, with a corresponding reduction for large orders. A very low price for steel underframes is, of course, out of the question until there is sufficient demand for them to make it worth while to introduce special machinery for their construction. This company is now building a large number of oil tank cars of an improved design, which has been approved by the Standard Oil Co. The building of oil cars will alone afford a large field for steel cars. The argument of the Harvey company is not without strong points. It says: "Anyone who will look into the subject will be satisfied that a superior car can be made of 6-in. steel I-beams for side and intermediate sills, and 12-in. steel channels for each of the two centre sills. By making the end sills of 6 in. steel beams flush at the top with the centre and side sills, the draft rigging can be placed just below the end sills and above the bottoms of the 12-in. channels, and thus bring the line of draft within the sills. This makes one of the simplest and best continuous draft gears. For buffing blows the wooden deadwood, or buffing block, reinforced with a plate to receive the blows from the buffer stop of the drawbar affords immeasurably greater durability than can be obtained with wooden sills. If, added to this, the buffer stop on the drawhead can be made to strike against the deadwood at least ⅛ in. before the spring closes up, there would be a decided decrease in the cost of maintenance of the draft springs and attachments. Harvey cars already constructed weigh about 5,000 lbs., each, less than a wooden car of the same capacity.

The Chignecto Ship Railroad.

Chief Engineer Ketchum has received orders from England to proceed with the work of pumping out the docks of the ship railroad, which is generally understood as an order to resume the work of finishing that undertaking. It is said that the water can all be pumped from the docks in three weeks, and if the work of finishing the roadbed, and equipping the line is pushed forward at once it is thought that it can be almost completed before next winter.

Launch of El Norte.

The steamer "El Norte," built for the Morgan Line by the Newport News Ship Building & Dry Dock Co., was launched at the Newport News yards at 1 o'clock last Tuesday. The launch was witnessed by probably 5,000 people, and the vessel was christened by Miss Mary Orcutt, daughter of the president of the ship building company. This vessel is one of four recently built or building for the Morgan Line. "El Sol" was launched at the Cramps' yards a year ago, and is now in service. "El Sud" was launched at the Newport News yards on March 16 last, and will make her trial trip in a few weeks. The fourth vessel, "El Rio," is now in the docks at Newport News. These vessels were designed as auxiliary cruisers or armed transports in case of need. They are fitted to carry guns, have powder magazines and a pretty large coal capacity. "El Norte" is 406 ft. long, 48 ft. beam and 33.9 ft. deep. She is expected to steam at about 16 knots an hour and to cost about $560,000. These four vessels were designed by Mr. Horace See, Superintendent of Construction of the Ship Building Company.

Prince Edward Island Tunnel.

With reference to the proposed tunnel to connect Prince Edward Island with the main land, Senator Howland, promoter of the scheme, says: "We are going to bore on the line of the tunnel every 500 yards, a distance of 60 ft. into the bottom all the way over and to make borings from 100 ft. to 200 ft. down to the bed rock on either side. These borings will be taken out by steam drills in cores of 10 ft. in length. When the borings are completed the cores will be boxed up and sent to the Public Works Department at Ottawa for the information of the government and also for affording complete information to contractors should the government decide to call for tenders. These will be accompanied by a complete trigonometrical survey, so at all times to accurately lay out the alignment. Mr. A. W. Palmer, Civil Engineer, has arrived with the proper appliances to commence work.

Consolidated Car Heating Co.

The annual meeting of the Consolidated Car Heating Co. was held at Albany last week. The affairs of the company were reported to be in a prosperous condition and the outlook for future business excellent. A semi-annual dividend of 1½ per cent. was declared, payable Aug. 5. Vice-President W. G. Rice reported that the sales had averaged over $1,000 for every working day of the past year. This included the product of Canadian factory at Coaticook, P. Q. The Sewall steam coupler and improved (McElroy) commingler are now used by roads having a mileage of 35,071 miles and 11,204 passenger cars. During the year 16,471 of these couplers have been sold. Officers were chosen as follows: President, Robert C. Pruyn, Albany; Vice-President and Treasurer, William G. Rice, Albany; Secretary, J. Peabody, South Orange, N. J.; General Manager, Daniel D. Sewall, New York; Mechanical Superintendent, James F. McElroy, Albany; Assistant General Manager, James H. Sewall, Chicago. The directors are: George Westinghouse, Jr., Pittsburgh, Pa; R. C. Blackall, Jr., Charles Tracey, Jr., and Anthony N. Brady, Jr., Albany; H. A. Osgood, Jr., and Albion Little, Jr., Portland, Me.; C. A. Jackson, Jr., and A. S. Hatch, Jr., New York, and G. L. Walker, Jr., Detroit, and the officers given above. After the election a visit was paid to the large new factory of the company just completed at Albany, N. Y.

Roller Bearings.

A car equipped with the Bruno Beaupre Anti-friction roller journal bearing is now being tested by the St. Paul Street Railway Co. No oil is used and the car has been in use for about two weeks doing excellent service. Starting tests were made between this car and an ordinary one and the anti-friction bearing car was started with 40 per cent. of the power required to start the other one.

Minneapolis, St. Paul & Buffalo Steamship Co.

The first of this company's "Whalebacks" will be launched by the American Steel Barge Co., at West Superior, Wis., on June 25. These vessels will be used for carrying package freight between Buffalo and Gladstone, Mich., the "Soo's lake port." The first two steamships will be named "Washburn" and "Pillsbury."

THE SCRAP HEAP.

Notes.

Trains were delayed on the Union Pacific by snow between Cheyenne and Laramie, Wyo., on June 5, and the rotary plow was used to clear the track.

The West Shore has recently caused the arrest of several persons for the illegal selling of tickets, and has discharged four passenger conductors. It is said that book tickets were manipulated so as to be used long after they had expired.

The Yard Masters' Association held its third annual convention at Lincoln, Neb., last week. A telegram was sent to President Harrison, thanking him for his efforts toward legislation to protect the lives of trainmen. Resolutions were adopted asking Congress to legislate on the same subject without delay.

Press dispatches report two collisions in England, resulting in the death of 10 persons. Near Guisely, on the Midland, June 9, two passenger trains ran together in consequence of some misunderstanding of signals, and five persons were killed and 20 injured. On the 14th two workingmen's trains on the Great Eastern collided in London, the number of killed being five and of injured eight. These two trains were filled largely with young women, many of whom went into hysterics or fainted.

The bridge spanning the Pennsylvania Railroad freight yard at Forty-fourth street, West Philadelphia, was badly wrecked on the morning of June 13 by the derailment of a car in a cattle train passing under it, which knocked out one of the iron columns supporting the bridge. About 2,000 sq. ft. of the bridge fell upon the tracks, making a bad wreck and blocking the road, except one main track, all day. The loss is estimated at $50,000.

The trainmen and telegraph operators of the Pittsburgh & Western, after negotiations lasting a considerable time, have secured an advance in wages by which nearly all of them secure increases of $2.50 a month and upward. A few of the freight train crews suffer a reduction. The lowest salary to be paid telegraph operators will be $42.50 a month, the minimum heretofore being $35. The majority will now receive $50 each. The newspapers state that a clause in the agreement provides that no operator under the age of 18 shall be employed.

Spanish-American Notes.

The employés of the Paulista Railway Co., Brazil, are threatening a strike for a 25 per cent. increase of wages.

The new branch of the Argentine Great Southern Railroad from Canuelas to Las Flores, a distance of 115 kilometres, was opened to traffic on May 1.

The Sao Paulo (Brazil) legislature has granted a subsidy of $100,000 to a local navigation company for carrying food products from the southern part of the state to the port of Santos.

The Fives Lille Co. has asked the Argentine Government to inspect and authorize the opening of the section of the San Cristobal-Tucuman Railroad from Sancho-Corrali to La Amora, a distance of 95 kilometres.

The Argentine Attorney-General has recommended that the Northeast Argentine Railroad be granted five years' extension of time in which to complete its line, upon condition of forfeiting its guarantee upon the finished sections during that period.

It is stated that the Central Railroad of Brazil is in need of extensive additions to its rolling stock, owing to the large increase in local passenger traffic. To meet the exigencies of the occasion it is affirmed by Engineer Lisboa that 100 new locomotives will have to be ordered.

The Brazilian Minister of Agriculture has refused to accede to the petition of the Estreito & Sao Francisco-Chopim Railroad for authority to raise a loan. This road enjoys a guarantee of interest upon a capital of $16,000 per kilometre, which the government deems amply sufficient for its needs.

Since Guatemala has received assurances that the foreign loan arranged a couple of years ago is to be carried through successfully, the Guatemalan congress has appropriated $1,500,000 toward the commencement of the Northern Railroad which is to connect the capital with Livingston on the Atlantic coast. When completed the city of Guatemala will thus be brought within five days of New York.

The Sorocabana Railroad Co., a Brazilian corporation, originally intended merely to connect the city of Sao Paulo with Tieté, a distance of 138 miles, is now proposing to extend its lines southward through Paraná into Rio Grande do Sul. If this plan should be carried out it will become the most important railroad in the republic, constituting, with its connections, a grand trunk line from Rio de Janeiro into the far south.

President Pelligrini in his message to the Argentine Congress expressed the opinion that "the guaranteed railroads must in future limit their working expenses to fifty per cent. of their receipts." The guaranteed railroads have been having a hard time of it for the past year, but some of them are now reviving. Argentine railroad stocks in general have begun to improve, and the Central Argentine has advanced to 67. This means a corresponding improvement in securities held by the Baring Estate, which will reflect beneficially upon Argentine finances.

The prospect of speedily obtaining railroad communication from Guayaquil to Riobamba, in the central plateau of Ecuador, is more encouraging than it has ever been before, and very considerable reliance may be placed upon the assertion of the contractors, Messrs. Kelly & Millet, of Guayaquil, that the road will be completed to Riobamba within three years. Transportation by mule at present costs $45 per ton on ordinary freight. The Compañia del Ferro-Carril y Obras Publicas de Guayaquil was organized a number of years ago, with the purpose of building a railroad to Riobamba. The first section of the road, as far as Chimbo, a distance of 63 miles, was constructed, and grading was continued about 12 miles farther, when the company's funds became exhausted. The government had given a seven per cent. interest guarantee upon a capital of 10,000,000 sucres, but the company realized that this guarantee would be of no service as long as the government was a defaulter upon its foreign loans. Accordingly it set out to re-establish the national credit, to which end it secured authority to propose to the foreign bondholders that they should accept new government bonds of £40 for every £100 of the principal of the existing debt, with interest thereon at 4½ per cent., secured by an increase of duties levied at the Guayaquil custom house. In addition to this a new railroad company, the Compañia del Ferro-Carril Nacional del Ecuador, Ld., was to be organized out of the personnel of the old Compañia del Ferro-Carril y Obras Publicas, which was then to absorb the old company and issue fully paid up shares in the railroad corporation to the bondholders of Ecuador in the proportion of £15 to every £100 of the new government bonds. This proposition was accepted on the 27th of last November, and both the railroad and the republic have thereby become rehabilitated, and the bondholders, who had feared a virtual repudiation of the debt, now have a prospect of retrieving the full amount through the co-operation of the government and the railroad.

An Elevated Electric Railroad in Baltimore.

The Lake Roland electric road of Baltimore has awarded a contract for the electrical equipment of its road to the Thomson-Houston Electric Co., of Boston, and to the Duplex Railway Co., of New York, for the track work. Work will be commenced next week on Cedar avenue, Baltimore. The contract for the elevated structure on North street will be let in a few days.

Standard Time in Belgium.

The mean time of the Greenwich meridian was formally adopted for all purposes in Belgium on May 1, 1892. The law authorizing the change was approved April 29 and published on the 30th. On the last named date the Minister of the Interior issued a proclamation to the local governments giving instructions in regard to carrying it into effect. In all cases where the districts were traversed by a line of railroad the time was to be taken from the railroad clocks, which are regulated by signals sent from the observatory of Necle, at Brussels. Where railroad stations could not readily be reached, if Brussels time had previously been used, the clocks were to be set back 17½ minutes. . . . The range of change was from 15 to 20 minutes. Belgium is the first of the countries of Europe to adopt the reform for civil life as well as for railroad time tables.—*Official Guide.*

Petroleum on the Suez Canal.

Sir Frederick Abel and Mr. Boverton Redwood, who have, at the request of British shipowners, been investigating the subject of the transport of petroleum in bulk through the Suez Canal, have issued a report, in which they express an opinion that, even with the strict enforcement of proper regulations, the passage of tank steamers laden with oil must involve risk to other shipping using the waterway. With proper stipulations as to the construction of tank vessels and rigid regulations affecting them during their passage, they admit that the risk might be to some extent reduced. Nevertheless, at a meeting of the shareholders in Paris May 31, M. Charles de Lesseps said that the Council could not refuse permission to tank ships to pass through the canal.

Historical Data from Baltimore.

To Baltimore, says Major J. G. Pangborn, belongs the distinction of having first conceived the railroad as the term is understood to-day, and to this city is due the honor of building the pioneer road of the world. Major Pangborn has been delving into history for months, and has been looking up on both sides of the Atlantic the facts bearing on the railroad. The result, he says, is a mass of proof showing that not until the meeting at Mr. George Brown's house, in Baltimore, Feb. 12, 1827, had there been a contemplation of a railroad save as a means of increasing the output of mines or quarries by facilitating transportation to waterways. In other words, all lines up to the organization of the Baltimore & Ohio Co. were tramways built by coal or quarry companies. The Stockton & Darlington, the English line that was opened in 1825, was a coal road, whose whole equipment consisted of "waggons" for carrying coal. Other freight was transported, but not by the company. Others ran "waggons" over the road when not interfering with coal traffic. As late as 1833, says the Major,

three years following the opening of the Baltimore & Ohio line, seven contractors had running privileges over the Stockton & Darlington for passenger carriages. It was not a railroad in the real sense, as a public servant, as was the Baltimore & Ohio from its inception, as the public had access only when the company was not discommoded thereby. Later it became a railroad. The Liverpool & Manchester was in reality the first European railroad, but it was opened to the public May 22, 1830, six months after the opening of the B. & O. The first shovelful of earth turned in the construction of a railroad in this country was on July 4, 1828, when the corner-stone of the B. & O. was laid. The first tram was the Leiper road in Pennsylvania, in 1809. It was 180 ft. long and was for mining. Later a similar one, a mile long, was constructed in Delaware County, Pennsylvania, to carry stone to Ridway Creek. A three-mile tram, for carrying stone exclusively, was built in Massachusetts in 1827. They have all passed away. The only one of the pioneer roads of the world retaining its original name, and which has ever maintained a regular succession of management, is the B. & O.—*Baltimore Sun.*

Transfer Boats on Lake Michigan.

The Green Bay, Winona & St. Paul has under contract two transfer boats to cross Lake Michigan from Kewaunee to Ludington, Mich. The transfer will be 50 miles, and the boats will make two trips a day, carrying 28 loaded freight cars on each trip. It is said that the boats cost nearly $250,000 each.

LOCOMOTIVE BUILDING.

The Cooke Locomotive & Machine Co. has just completed an order for 22 10 wheel engines for the Houston & Texas Central. They have 19×24-in. cylinders and 54-in. driving wheels. Weight of engine, light, is 96,500 lbs. It is equipped with Richardson-Allen balanced valves and Westinghouse brake equipment.

The Dickson Manufacturing Co., of Scranton, has begun the delivery of the 10 Consolidation engines ordered by the New York, Ontario & Western early in May, and they are to be delivered at the rate of two a month. They are intended for freight service, but will be used during the summer on passenger trains.

The contract for 10 new passenger engines for the Baltimore & Ohio Railroad has been given to the Baldwin Locomotive Works, of Philadelphia. The engines are to be completed by the middle of August. Three of them will be built according to designs of the Baldwin Locomotive Works and seven according to designs of Mr. Hazelhurst, General Superintendent of Motive Power of the Baltimore & Ohio.

The Cooke Locomotive & Machine Co. has recently booked orders as follows: One mogul switching and three additional 8-wheel passenger engines for Delaware, Lackawanna & Western, three 8-wheel passenger engines with 18×24 in. cylinders for the Evansville & Terre Haute, and one 8-wheel passenger engine, anthracite coal burning, with 18×24-in. cylinders and 66-in. drivers for the Lehigh & Hudson River road.

The Cooke Locomotive Co. is now engaged on three fast passenger anthracite coal burning engines for the Delaware, Lackawanna & Western. The cylinders are 19 × 24 in., drivers 64½ in. diameter, Krupp tires and Boies wheels are on both engines and tenders, and the engines have Richardson-Allen balanced valves and Westinghouse brakes. Three large 10-wheel engines having cylinders 21 × 26 in. and drivers 56 in. diameter are being built for the Everett & Monte Christo road, of Washington. Delivery of the 20 consolidation and five 10-wheel passenger engines for the Louisville & Nashville will commence this month and continue throughout July and August.

The Schenectady Locomotive Works have completed a large part of the order for 27 compound locomotives for the Southern Pacific. Twenty of the engines are 12-wheel compounds for freight service on the Mountain division, and the balance are 10-wheel engines for passenger service between Oakland and Sacramento (90 miles). The overland passenger trains are now run in two sections on the western division, the present engines being too light for the trains, but the new engines will do away with this inconvenience. Recently one of these engines (No. 1,789) hauled a train of 17 cars, of which eight were Pullman sleepers, leaving Oakland 10 minutes late and arrived at Lathrop 83 miles from Oakland) on time. The freight engines on the Sacramento division can only haul 12 or 15 loaded cars, and a helping engine is needed on all trains, but the new engines will be heavy enough to haul 15 cars without a second engine.

CAR BUILDING.

The Norfolk Southern has ordered 50 60,000-lb. box cars from the Tredegar Iron Works, of Richmond, Va. The cars are to have the Hutchins roof.

Twenty-five cars have been completed at the new shops of the Northern Pacific, at Edison, Wash. These are a part of the first order given to the shops, which was for 200 of Street's stable cars.

The Southern Pacific has nearly completed 16 new cabooses at its Sacramento shops. The company will receive in a few days, 22 passenger cars from the Pullman Car Co., which were ordered in January.

The Michigan Central has just completed at the St. Thomas shops two elegantly appointed passenger cars and a baggage car for the Niagara branch, which are said to be the first passenger cars built at these shops.

BRIDGE BUILDING.

Bay City, Mich.—The Bay County Bridge Commission publishes a notice of an application to construct a bridge across the Saginaw River, between the cities of Bay City and West Bay City, which will be presented to the Board of Supervisors July 1. The total length of the bridge will be 1,754 ft., the width 32 ft., and the heighth 15 ft. The bridge will have a draw span of 260 ft. and two other spans of 143 ft.

Brainerd, Minn.—The proposed combination iron and wood bridge for the Brainerd & Northern Minnesota Railroad, to be built across the Mississippi River at Brainerd, will be 750 ft. long, including a combination truss span 150 ft. in length. The contract has been awarded to the Wisconsin Bridge & Iron Co., of Milwaukee. A pile bridge 800 ft. long will also be built across the Narrows at the north end of Gull Lake.

Chicago.—The City Council has awarded to Shailer & Schniglau, of Chicago, the contract for the lift bridge across the river at Canal street, which will cost $40,000.

Cleveland, O.—The Cleveland, Canton & Southern has submitted plans to the Board of Control for a new iron swing-bridge to replace the stationary wooden bridge of the company across the river. The new bridge will have a channel span of 72 ft. The plans were referred to the Board of Public Works.

Cook County, Ill.—The Massillon Bridge Co. has just been awarded a contract at $2,500 for building a highway bridge in Cook County.

East Templeton, Que.—The reeves and counselors of Gatineau Point and East Templeton have decided to support the construction of a bridge over the Gatineau River, province of Quebec, and a committee has been appointed to select the site. The cost of the bridge is estimated at $40,000. The sum of $30,000 has already been voted, and it is expected the townships of Buckingham and L'Ange Gardien will vote $5,000 each.

Houston, Tex.—The War Department has reported against the plans for the proposed bridge across the Buffalo Bayou, the contract for which has been let to the King Bridge Co., of Cleveland. The bridge was to be a draw truss of 260 ft., giving a clear width over the bayou of 112½ ft., but the army engineers objected to the proposed location of the pivot pier. An attempt will be made to secure another location for the bridge, but the city will probably be compelled to declare the contract void.

McKeesport, Pa.—The contract will be awarded this week for a foot bridge to connect Boston and Grenoak, near McKeesport, to cost $50,000. Another bridge between Suter and Douglass, to cost $60,000, will be erected, and a railroad bridge will also be built in that vicinity to connect the Waverly Coal Co. with the Pittsburgh, McKeesport & Youghiogheny and Pittsburgh & Lake Erie roads.

Moline, Ill.—The President has approved the act for a bridge across the Mississippi River at Moline.

Newark, N. J.—The freeholders have decided to build a new bridge across the Passaic River in the old Twelfth Ward, but the building of the bridge will probably be delayed owing to objections made against the proposed location of the structure.

Ottawa, Ont.—Tenders will soon be called for the construction of a railroad bridge across the Madawaska River, in connection with the Ottawa & Parry Sound road, the bridge to cost $40,000.

Piqua, O.—The County Commissioners will construct a new iron truss bridge in Bethel Township over Lower Honey Creek.

Rapid City, S. D.—Proposals are wanted by the County Auditors until July 5 for erecting a bridge over Rapid Creek.

Riverton, Va.—The Front Royal & Riverton Improve-Co. has let the contract to the Wrought Iron Bridge Co., of Canton, O., for the construction of two iron bridges at Riverton to cost $24,974.

Salamanca, N. Y.—The New York, Lake Erie & Western is putting in two new 94-ft. plate girder bridges on the Western division, near Salamanca. The contract has been awarded to the Elmira Bridge Works.

San Francisco, Cal.—Property owners in South San Francisco have asked the Board of Supervisors to condemn the old wooden bridge spanning Channel street at Fourth and that a steel drawbridge be erected in its stead.

Sioux City, Ia.—The introduction of a bill in Congress to grant a charter to the Interstate Bridge Co. to build a bridge across the Missouri River at Sioux City, Ia., has aroused new interest in the possibility of the completion of the Pacific Short Line bridge. Mr. A. S. Garretson, President of the company, states that over $300,000 has so far been expended on the piers of the bridge by Sooysmith & Co. and on the iron work by the Phœnix Bridge Co. He insists that there is no doubt of the completion of the bridge with accommodations for railroad, wagon and foot traffic.

Vernon, Ind.—Proposals are wanted by the Auditors until June 21, for the construction of a highway bridge over Graham Creek, in Bigger Township.

Washington, D. C.—The President has approved the act for a bridge across the Illinois River near Havana, Ill., and the act for a bridge over the Tennesse River, near Clifton, Tenn. An adverse report has been made on the bill to authorize the Philadelphia & Camden Bridge Co. to erect a bridge over the Delaware River at Philadelphia and the bill placed on the calendar.

Winnipeg, Man.—The Norwood Improvement Co., has, it is announced, completed the arrangements for building the iron bridge across the Red River to Ft. Rouge, which was to have been under contract early in the spring. The syndicate that is to build the bridge is much the same as the one that controls the new Winnipeg electric road.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Boston & Albany, quarterly, 2 per cent., payable June 30.

Boston & Providence, quarterly, 2½ per cent., payable July 1.

Lehigh Valley, quarterly, 1¼ per cent., payable July 15.

Manhattan Elevated, quarterly, 1½ per cent. on the capital stock, payable July 1.

New York, New Haven & Hartford, quarterly, 2½ per cent., payable July 1.

Northern Central, semi-annual, 3 per cent, payable July 15.

Pennsylvania & Northwestern, semi-annual, 3 per cent., payable July 9.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Chicago Junction Railways & Union Stock Yards Co., annual, Jersey City, N. J., July 7.

Duluth & Winnipeg, special, Duluth, Minn., June 21.

Fort Worth & Trinity Valley, annual, Fort Worth, Tex., June 25.

Illinois Central, special, Chicago, Ill., June 18.

International & Great Northern, special, Palestine, Tex., July 14.

Mobile & Girard, annual, Girard, Ala., July 6.

Minneapolis, St. Paul & Sault Ste. Marie, annual, Minneapolis, Minn., June 21.

Schuylkill & Lehigh Valley, special, New York, N. Y., June 27.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *American Railway Master Mechanics' Association* will hold its annual convention at Congress Hall, Saratoga Springs, June 20.

The *American Association of General Baggage Agents* will hold its next annual meeting at Mackinac Island, Mich., July 20.

The *New England Railroad Club* holds regular meetings, at the United States Hotel, Beach street, Boston, Mass., on the second Monday of each alternate month, commencing January.

The *Western Railway Club* holds regular meetings on the third Tuesday in each month, except June, July and August, at the rooms of the Central Traffic Association in the Rookery Building, Chicago, at 2 p. m.

The *New York Railroad Club* holds regular meetings on the third Thursday in each month, at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, N. Y.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, the fourth Wednesday of January, March, May, September and November. By special resolution the next meeting will be held in April.

The *Northwest Railroad Club* meets on the first Saturday of each month, except June, July and August, in the St. Paul Union Station, at 7:30 p. m.

The *Northwestern Track and Bridge Association* meets on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m. in the directors' room of the St. Paul Union Station.

The *American Society of Civil Engineers* holds its regular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third street, New York.

The *Boston Society of Civil Engineers* holds its regular meetings at the American House, Boston, at 7:30 p. m., on the third Wednesday in each month.

The *Western Society of Engineers* holds its regular meetings at 78 La Salle street, Chicago, at 8 p. m., on the first Wednesday in each month.

The *Engineers' Club of St. Louis* holds regular meetings in the club's room, Laclede Building, corner Fourth and Olive streets, St. Louis, on the first and third Wednesday in each month.

The *Engineers' Club of Philadelphia* holds regular meetings at the House of the Club, 1,122 Girard street, Philadelphia, on the first and third Saturday of each month. The annual meeting is held on the third Saturday in January. The club stands adjourned during the months of July, August and September.

The *Engineers' Society of Western Pennsylvania* holds regular meetings on the third Tuesday in each month, at 7:30 p. m., at its rooms in the Thaw Mansion, Fifth street, Pittsburgh, Pa.

The *Engineers' Club of Cincinnati* holds its regular meetings at 8 p. m. on the third Thursday of each month in the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati.

The *Civil Engineers' Club of Cleveland* holds regular meetings on the second Tuesday of each month, at 8 p. m., in the Case Library Building, Cleveland. Semi-monthly meetings are held on the fourth Tuesday of the month.

The *Engineers' Club of Kansas City* meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The *Engineering Association of the South* holds its monthly meetings on the second Thursday at 8 p. m. The Association headquarters are at Nos. 63 and 64 Baxter Court, Nashville, Tenn.

The *Denver Society of Civil Engineers and Architects* holds regular meetings at 36 Jacobson Block, Denver, Col., on the second and fourth Tuesday of each month, at 8 o'clock p. m., except during June, July and August, when they are held on the second Tuesday only.

The *Civil Engineers' Society of St. Paul* meets at St. Paul, Minn., on the first Monday in each month.

The *Montana Society of Civil Engineers* meets at Helena, Mont., at 7:30 p. m., on the third Saturday in each month.

The *Civil Engineers' Association of Kansas* holds regular meetings at Wichita on the second Wednesday of each month at 7:30 p. m.

The *American Society of Swedish Engineers* holds meetings at the club house, 250 Union street, Brooklyn, N. Y., and at 347 North Ninth street, Philadelphia, on the first Saturday of each month.

The *Engineers' Club of Minneapolis* meets the first Thursday of each month in the Public Library Building, Minneapolis, Minn.

The *Canadian Society of Civil Engineers* holds regular meetings at its rooms, 112 Mansfield street, Montreal, P. Que., every alternate Thursday except during the months of June, July, August and September.

The *Association of Civil Engineers of Dallas* meets at 803 Commerce street, Dallas, Tex., on the first Friday of each month at 4 o'clock p. m.

The *Technical Society of the Pacific Coast* holds regular meetings at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., at 8 o'clock p. m. on the first Friday of each month.

The *Tacoma Society of Civil Engineers and Architects* holds regular meetings on the third Friday of each month, in its rooms, 201 and 202 Washington Building, Tacoma, Wash.

The *Engineers and Architects' Club of Louisville* holds regular meetings on the second Thursday of each month, at 8 o'clock p. m., at its rooms in the Norton Building, Louisville, Ky.

The *Association of Engineers of Virginia* holds regular meetings at Roanoke, on the second Saturday in each month, at 8 p. m., except the months of July and August.

Engineers' Club of Philadelphia.

The next business meeting of the club will be held on Saturday, June 18, at 8 o'clock. A circular letter will be read from the Secretary of the American Society of Civil Engineers in reference to the proposed Engineering Congress to be held at the World's Fair at Chicago in 1893. This meeting, it is expected, will take the place of the annual convention of the society for 1893. The rule that authors of papers read at the annual convention shall be members of the society will not be enforced. Mr. Collingwood suggests that the club name one of its members to aid the committee of the Am. Soc. C. E., having the matter in charge, by the suggestion of persons who are in position to furnish papers which would be a credit to American engineering and of general interest to the profession.

At the regular meeting on June 4, President Christie in the chair, 30 persons were present. The Secretary

announced the appointment of Prof. L. P. Rondella as secretary of the club to fill the unexpired term of Mr. John C. Trautwine, Jr., resigned.

SHEARING OF IRON AND STEEL.

Mr. Henrik V. Loss started a discussion on the above subject by calling attention to the fact that while engineers were familiar with the action of other forces upon metal generally, they were yet much in doubt with regard to shearing. He considered hydraulic machinery the only available kind for accurate shearing tests, and described the results of a series of experiments that he had been making, but had not yet completed. From cards which he had taken he found that it requires more power to cut iron than steel of the same dimensions and less power for both metals than is generally supposed. Mr. John C. Trautwine, Jr., attributed the differences in the behavior of these two metals to the brittleness of steel compared with the tougher iron, and called attention to observations similar to those of Mr. Loss, by Mr. F. H. Lewis, printed in his paper entitled "Soft Steel in Bridges." Mr. A. Falkenau cited a case of a breaking pin in a compressing machine which persistently sheared off very suddenly, sometimes even under a strain less than its elastic limit. Other members called attention to the facts that steel tanks holding water rusted much more quickly than iron ones used for the same purpose, and that pipes carrying oil seemed to rust more quickly than those carrying water.

VALVES FOR HIGH-PRESSURE PUMPS.

Mr. Loss asked the opinion of members on the proper proportion of valve to cylinder areas in high-pressure pumps. He considered flat better than cone-seated valves, and thought the valve area should be about 30 per cent. of the area of the plunger. Mr. Max Livingston called attention to an article in the Proceedings of the Society of Mechanical Engineers, by Prof. Denton, describing a Worthington pump, the action of whose valves produced results which were then phenomenal, but have since been exceeded. The Riedler valve, a recent German invention, was described and favorably commented upon by Mr. Morris and others, and there was a general discussion upon other types.

Franklin Institute.

The programme for the stated meeting of the Institute at Philadelphia on June 15 included papers on the present status of the railroad battery system for electric street railway propulsion, by Mr. P. G. Salom, and a paper on the proposed electric road from Chicago to St. Louis by Dr. Wellington Adams.

At the stated meeting on May 18 Joseph M. Wilson, President, in the chair, there were present 132 members and 22 visitors. Mr. W. S. Collins, of New York, read a paper descriptive of the system of using petroleum for fuel purposes, as practiced by the Aerated Fuel Co., of Springfield, Mass., illustrating with the aid of lantern slides the mechanical features of the same. The system consists substantially in the employment of compressed air as the vehicle for conveying the oil to the point of combustion, and spraying it into the furnace. This method permits of the location of the oil reservoir below the level of the furnaces, thus obviating the danger of flooding the latter with oil in the event of accident by leakage or break down. The system has been fully described in the *Railroad Gazette*.

Freight Claim Association.

The Freight Claim Association will hold its regular semi-annual meeting at Saratoga, N. Y., on Wednesday, Aug. 10. S. A. Meborter, 243 South Fourth street, Philadelphia, is Secretary.

PERSONAL.

—Mr. G. F. Gilfillan, Assistant General Passenger Agent of the St. Paul & Duluth, has resigned.

—Mr. Paul Heinrich, Assistant Auditor of the Burlington & Missouri River road, died a few days ago at Omaha, Neb.

—Mr. F. E. Fisher recently resigned as General Freight and Passenger Agent of the St. Louis, Alton & Springfield, to accept a position on the Ohio Southern.

—Mr. M. D. Nottage, Division Superintendent of the St. Louis Southwestern, was seriously injured last week by being thrown under the wheels of a hand car while making an inspection of overflowed track.

—Mr. S. H. Hardwick, recently of the Central of Georgia, has been appointed Assistant General Passenger Agent of the Richmond & Danville. His headquarters will be in Washington, D. C., and he will be in charge of the business of that road in the East.

—Mr. J. B. Buchanan has declined the Chairmanship of the Western Passenger Association, to which he was elected, June 2, to succeed Mr. W. W. Finley. Mr. Buchanan has been General Passenger Agent of the Fremont, Elkhorn & Missouri Valley road since 1881.

—Mr. J. A. Haskell, who has been General Manager of the Helvetia Mining Co., and of the Mahoning Valley Railroad, which it controls, recently resigned, having been elected Vice-President of the Hercules Powder Co., and he has now been made President of the latter company.

—Mr. Herbert Higgins, Master Mechanic of the Great Northern at Barnesville, Minn., who has resigned to accept a position on the Atchison, Topeka & Santa Fe, at La Junta, Col., received last week a silver set from the employés. He was connected with the Great Northern for 10 years as General Foreman of Machinery on the northern division.

—Mr. J. D. Farrall, Superintendent of the Chicago division of the Chicago, St. Paul & Kansas City, resigned this week, and has accepted a position as Division Superintendent on the Great Northern road. He has been connected with the Chicago, St. Paul & Kansas City since 1889, when Mr. J. M. Egan, under whom he had served since 1881 on the Canadian Pacific and other roads, became General Manager of the company.

Mr. T. C. McNeely has been appointed Superintendent of the main stem of the Central, of Georgia, to succeed Mr. H. R. Dill, who recently resigned. The new superintendent is about 30 years of age. He began railroad life as a telegrapher when quite young at Salisbury, N. C., and was afterward made trainmaster on the Western North Carolina Railroad at Asheville. Several years ago he became chief clerk to Superintendent V. E. McBee, of the Western North Carolina division of the Richmond & Danville, and removed to Savannah when Mr. McBee became General Superintendent of the Central, of Georgia.

—On account of the development of his private practice as Consulting Bridge Engineer, Mr J. A. L. Waddell, of Kansas City, Mo., has resigned the Western Agency of the Phœnix Bridge Co. and the Phœnix Iron Co. which agencies he has held since Jan. 1, 1887. His resignation will take effect July 1.

Mr. A. C. Stites, who has been Mr. Waddell's principal assistant for four years, will take the agencies of the two companies, with headquarters at 121 Laclede Building, St. Louis. Mr. Stites will also take charge of a branch engineering office for Mr. Waddell, whose main office will still be at Kansas City.

—Mr. J. L. Greatsinger, who has just been elected President of the Duluth & Iron Range, began his railroad career as a firemen in 1872. He held various positions, and about 1885 was appointed Master Mechanic of the Chicago & Indiana Coal Co. In 1888 he resigned that position to accept a similar one with the Duluth & Iron Range, continuing as Master Mechanic for two years. He was then promoted to the position of General Superintendent. He held the latter position until March of the present year, when he was appointed General Manager, and he still retains the title and duties of that office in addition to the new ones of President.

—Mr. Charles M. Levey has been appointed Superintendent of the Iowa lines of the Chicago, Burlington & Quincy, with headquarters at Burlington, Ia., vice C. G. Wilson, deceased. Mr. Levey was General Superintendent of the St. Louis, Keokuk & Northwestern previous to this last appointment. He is 34 years of age, and began railroading November, 1872, on the Burlington under the late Thomas J. Potter. The office of general superintendent of the St. Louis, Keokuk & Northwestern, and the Chicago, Burlington & Kansas City at Keokuk, has been abolished, the duties being assumed by Mr. S. F. Crance, General Superintendent of the Hannibal & St. Joseph.

—Mr. Edwin McNeill, General Superintendent of the Pacific Division of the Union Pacific, with headquarters at Portland, Ore., tendered his resignation last week, to take effect July 1. He will probably engage in business at Portland. Mr. Robert W. Baxter, Superintendent of the Mountain Division for the past five months, is mentioned as his successor. Mr. McNeill was formerly General Superintendent of the Hartford & Connecticut Western, and also President of the Shepaug, Litchfield & Northern, leaving the East to become General Manager of the St. Joseph & Grand Island road. He has been connected with the Union Pacific for the last four or five years, ane has been General Superintendent of the Pacific Division since January, 1891.

—Mr. Sidney Dillon died at his home in New York at 11 o'clock on the morning of June 9, after an illness of about three months. Mr. Dillon was born at Northampton, N. Y., May 7, 1812. His grandfather was an Irishman, who had been a soldier in the Revolution and who left to his son a small farm. The son's family grew up in comparative poverty, and Sidney Dillon, the oldest, had but little education. When he was but a child he became a water-boy on the Mohawk & Hudson Railroad, then constructing. Later he became foreman for Jonathan Crane and John T. Clark, engaged in building the Boston & Providence Railroad. Afterward he was foreman in the construction of the Stonington Railroad, and in 1838 secured a contract on the Western Railroad of Massachusetts. From this time on he carried on the work of a contractor steadily and with great success. In 1865 he became interested in the construction of the Union Pacific Railroad, of which company he was a director from its organization until his death. In his vast contracts he acquired a large fortune. In 1869 he drove the last spike at the connection of the Union Pacific and Central Pacific railroads at Promontory Point. He became President of the Union Pacific in 1879. In 1884 he was succeeded by Mr. Charles Francis Adams, but again in 1890 Mr. Dillon became President. At the last election he retired. It is estimated that the railroads that he built aggregated over 25,000 miles. He was a man of great intellectual and physical force, and has been closely associated with Jay Gould for many years.

ELECTIONS AND APPOINTMENTS.

Baltimore & Ohio.—James Potter has been appointed District Passenger Agent of the company, located in Philadelphia, in place of Charles R. Mackenzie, who had occupied the position for a number of years. Mr. Potter was formerly City Passenger Agent.

Baltimore & Potomac.—The annual meeting was held last week. The following directors were elected: Frank Thomson, B. F. Newcomer, W. T. Walters, R. D. Barclay, Samuel Cox, Jr., Francis T. Smith, John Cassels. The board elected the following officers: Oden Bowie, President; Frank Thomson and William J. Sewell, Vice-Presidents; John S. Lieb, Treasurer; James P. Kerr, Secretary.

Charleroi & Belle Vernon.—The following are the incorporators: William D. Hortupee, Charleroi, Pa., President; directors, J. M. Moore and M. J. Alexander, Greensburg; Robert J. Linton, Belle Vernon, and Levi Newcolm, Charleroi.

Chicago, Burlington & Northern.—At the annual meeting at La Crosse, Wis., on June 8, the following directors were elected: J. M. Forbes, C. J. Paine, T. J. Coolidge, J. T. Gardner, C. E. Perkins, F. W. Honnewell and Richard Olney. No meeting of the directors has yet been held.

Chicago, Kansas & Nebraska.—The annual meeting of the stockholders was held at Topeka, Kan., last week. The old board was re-elected, as follows: M. A. Knowles, C. F. Jillson, J. B. Bartholomew, S. T. Howe, and P. I. Bonebrake, of Topeka; H. A. Parkhurst, of Chicago, and George W. Samuels, of St. Joseph, Mo.

Chicago, St. Paul & Kansas City.—J. D. Farrell having resigned as Superintendent of the Chicago Division, D. McNab has been appointed to succeed him, and will have jurisdiction from Forest Home to Dubuque, Ia. J. D. Tuoby has been appointed Superintendent of Terminals at Chicago. The headquarters of both the above officials are at Chicago.

Chicago & West Michigan.—B. F. Popple has been appointed General Eastern Agent of this line, with headquarters at No 375 Broadway, New York, N. Y.

College Hill Marginal.—The directors are: John C. Whitlo, Beaver Falls, Pa., President; Wm. H. Parlington, College Hill, Pa.; Martin L. Knight, Jas. E. Emerson, Edwin S. Weyand, James P. Stone and Simon Harrold, of Beaver Falls.

Duluth & Iron Range.—At the annual meeting, at Duluth, June 6, J. H. Chandler was elected a director, in place of H. R. Bishop, and J. L. Greatsinger in place of M. J. Carpenter; all the other directors were re-elected. J. L. Greatsinger was elected President.

Fair Hill.—The incorporators of the company are J. N. Du Barry, Philadelphia, President; Joseph M. Crawford, William J. Latta, John B. Stauffer, Henry D. Welsh, Philadelphia; William K. Patton, Radnor, Pa.; N. Parker Shortlidge, Wynnewood, Pa.

Fitchburg.—G. E. Dudley, Division Freight Agent at Troy, N. Y., has been transferred to Boston, where he will fill the office of General Eastern Agent of the road.

Florida Coast & Gulf.—The company has been chartered in Florida by John Bushnell, of Plainfield, N. J.; George W. Colton, George Cheseboro and W. A. Harris, of Brooklyn, N. Y., and L. R. Dyer, of New York.

Fort Wayne & Belle Isle.—The following is a complete list of the directors: Stephen B. Grummond, Nathan W. Goodwin, James H. Vhay, Chas. E. Kouter, Emil S. Heineman, Seligman Schloss and Dexter M. Ferry, all of Detroit.

Grand Trunk.—The recent changes in the engineering organization of the engineering department announced on June 1, were published in this column June 3, page 418, under the name of the Great Northern, but the error was on obvious one.

Great Northern.—J. D. Farrell has been appointed Division Superintendent, with jurisdiction from Kalisfield, Mont., to Spokane, Wash.

Housatonic.—New directors, representing the New York, New Haven & Hartford, were elected at Bridgeport, Conn., this week. The following is the board of officers as at present made up: President, George M. Miller; Vice-President, W. E. Barnett; General Superintendent, C. H. Platt; Secretary and Treasurer, M. E. Stone. Directors: George M. Miller, William Rockefeller, Charles P. Clark, Lucius Tuttle, Charles Lanier, W. E. Barnett, J. Pierpont Morgan, A. B. Mygatt and W. E. Downes.

Jalisco Pacific.—The following is a corrected list of the directors of this company: William J. Palmer, Geo. B. Moffat, William Hinchman, Geo. Foster Peabody, Chas. W. Drake, John Pratt, Spencer Trask, and Chas. J. Peabody, of New York, and James Sullivan, Louis Mendez and Henry P. Webb, of Mexico, and two others, to be appointed by the Mexican Government in accordance with the concession. The officers are: President, W. J. Palmer; Vice-President, George B. Moffat; Treasurer, Walter Hinchman; and Secretary, John Pratt.

Lancaster, Oxford & Southern.—The stockholders of the railroad elected directors at a meeting in Elkton, Md., last week, as follows: Walter M. Franklin, Joseph M. Showalter, Wm. T. Warburton, J. W. B. Bancman, J. E. Ramsay, Robert B. Patterson and John C. Hager.

Mexican Northern Pacific.—The name of the present company is the Mexican Northern Pacific Railway Co., Limited. It is organized under the laws of Great Britain, and the English office is located in Winchester House, London. The Chief Executive Officer is Thomas Sutherst, of the Temple, London, and among its directors are Sir Edward Watkin, Lord Monkswell, Col. Surtees, Director of the London & Southeastern, and Sir James Kitson. The Engineers-in-Chief are Sir Douglas Fox and Edward Wood, Esq. The Resident Engineer is William Martineau. The representative of the company in the United States and Mexico is William H. Davis, whose address is 951 The Rookery, Chicago, where the principal offices of the company are located.

Minnesota Transfer Railway Co.—At the annual meeting in St. Paul on June 8 the old board of directors was re-elected. The following officers were chosen: W. H. Truesdale, President; John R. Hastings, Vice-President; A. H. Bode, Secretary, and H. P. Upham, Treasurer.

New Haven & Derby.—The following directors, representing the old Housatonic interest, have resigned: President, W. H. Stevenson, and J. L. Macaulay, Henry Hentz, E. V. Cary, M. E. Stone and A. J. Router. They have been succeeded by Lucius Tuttle, chosen President, and Charles P. Clark, William Rockefeller, Lucius Tuttle, J. Pierpont Morgan, W. E. Barnett and N. D. Sperry, who represent the New York, New Haven & Hartford.

Norfolk, Wilmington & Charleston.—The companies organized under state charters for this road were consolidated under the above name at Philadelphia last week, and the following officers and directors elected for the entire system: Officers: John C. McNaughton, President; Andrew A. Gaddis, Vice-President; R. Duncan Harris, Treasurer; Chambers H. McKibbin, General Manager, and Carroll Forster, Secretary. Directors: Alex. C. Haskell, Columbia, S. C.; R. Duncan Harris, New York, N. Y.; Thomas J. Jarvis, Greenville, N. C.; M. L. Eure, Norfolk, Va.; John C. McNaughton, Chambers H. McKibbin and J. H. Wheeler, Philadelphia, Pa.; Henry E. Young, Andrew A. Gaddis, T. A. Huegenin and J. F. Redding, Charleston, S. C.; Jacob L. Stadelman, Ardmore, Pa.; P. J. Ferguson, Shenandoah, Pa.; T. A. Green, New Berne, N. C.; J. S. Mitchell, Winton, N. C.; A. S. Cadwallader, Yardley, Pa. The principal office is at 212 South Third street, Philadelphia.

Ogdensburg & Lake Champlain.—At the annual meeting held in Ogdensburg, N. Y., June 15, the following directors were elected: B. B. Smally, E. C. Smith, W. J. Averell, J. R. Langdon, Jr., W. Hobart, S. A. Carlton, D. W. Lawrence, J. H. Kimball, F. S. Stranahan, C. W. Witters, Louis Hasbrouck, James Averill, Jr., and Charles Parsons, Jr. The board is the same as last year with the exception of Mr. Parsons, who succeeds the late J. Gregory Smith.

Osceola Lake & Wexford.—The names and addresses of the incorporators of the company are as follows: Clyde C. Chittenden, George E. Herrick, Ida L. Chittenden and Fred. S. Lamb, all of Cadillac, Mich.

Pennsylvania Co.—The annual meeting was held at Pittsburgh last week. The following were elected directors: James McCrea, J. T. Brooks, Thomas D. Messler, John E. Davidson, of Pittsburgh; G. B. Roberts, Henry H. Houston, Frank Thomson, Henry D. Welsh, J. M. DuBarry, John P. Green, William H. Barnes, Amos R. Little and N. P. Shortridge, of Philadelphia. There was no change in the directory.

Philadelphia & Reading.—William B. Smith has been appointed General Eastern Passenger Agent of the Eastern and Northern divisions, with office at 235

Broadway, New York. Mr. Smith was formerly General Eastern Passenger Agent of the Lehigh Valley.

B. I. Sheafer, Station Agent at Pottsville, Pa., will assume control of the office of Division General Freight Agent of the Schuylkill & Lehigh branch, vice C. A. Blood, resigned.

Pueblo, Gunnison & Pacific.—At a meeting of the directors at Pueblo, Col., June 9, Charles Henkel was elected President; J. B. Ormon, Vice-President; Robert Gibson, Treasurer; F. A. Townsend, Secretary.

Richmond & Danville.—S. H. Hardwick has been appointed Assistant General Passenger Agent, with office at 1300 Pennsylvania Avenue, Washington, D. C., and has been assigned to the territory embracing Washington and east of Washington.

Shepaug, Litchfield & Northern.—The following resignations were received and accepted at the meeting on June 15: J. L. Macaulay as President, and J. L. Macaulay, W. H. Starbuck, P. P. Hubbard and E. V. Cary as directors. Their places were filled by Charles P. Clark as President, and C. P. Clark, J. Pierpont Morgan, William Rockefeller and Lucius Tuttle, of the New York, New Haven & Hartford.

Slackwater Connecting.—A charter for the company was filed in Pennsylvania last week by the following directors: Henry C. Fownes, Pittsburgh, President; James Hemphill, Wm. C. Fownes, Edwin C. Fownes and Vitalius Mathews, all of Pittsburgh, and Joseph S. Brown, Allegheny.

Unaka & Nola Chucky.—The officers of the company are: A. S. Johnson, President, Chucky City, Tenn.; J. L. Cain, Vice-President, Morristown, Tenn., and R. A. Bowie, Chief Engineer, Greenville, Tenn.

Winnipeg & Southeastern.—At the annual meeting of the company at Winnipeg, Man., the following directors were elected: Charles Hoare, A. F. Eden, L. Dwight, James O'Connor, Robert Bullock, Alexander Logan, H. M. Arnold. A. F. Eden was elected President, and James O'Connor, Vice President.

RAILROAD CONSTRUCTION.
Incorporations, Surveys, Etc.

Austin & Northwestern.—The Llano extension, which begins at Fairland, six miles south of Marble Falls, Tex., the northern terminus of this road, and extends westerly to the town of Llano, a distance of 26 miles, was completed into the latter town on June 7, and the first train was run on that day. Llano is in a district famous for quarries of marble and granite of good quality, and is the centre of an iron district.

Baltimore & Cumberland.—The preliminary survey between Hancock, Md., on the Potomac River, and State Line, Pa., referred to last week on page 437 under "New Roads" is being made by engineers of this company. The intention is to survey a line which will connect this road, now located through Hancock, with the Cumberland Valley road at State Line, the distance being about 25 miles.

Brainerd & Northern Minnesota.—The preliminary survey for 45 miles of the road north of Brainerd, Minn., has been completed, and 14 miles has been located and the contract awarded to George Sharer, who has begun grading. The contract for the work between Brainerd and Township 135 will be let this week, and the work pushed as rapidly as possible. It is expected to complete the 45 miles of road surveyed this year, and the balance of the line will probably be soon under contract. The surveys have been made from Brainerd northerly to Long Lake and Lake Hubert; westerly to Fish Trap Lake, thence northerly to the crossing of the narrows between upper and lower Gull Lake and westerly between R. 31 and 32 to Sec. 19, R. 31, T. 140. The line will probably be extended north of this point, but the terminus has not yet been decided. There will be an iron bridge across the Mississippi River at Brainerd, and a long trestle at Gull Lake. The country through which the road is to be built is generally rough; the character of the soil to be removed is sandy, with considerable surface rock. Maximum grades will be 66 ft. to the mile, and maximum curves 10 degrees. D. Forneri, of Brainerd, Minn., is Chief Engineer.

Bristol, Elizabeth & North Carolina.—A large force is now working on the Maine line south of Bristol, Tenn., near Elizabethton, N. C., and trains will be running from Bristol to the iron mines in less than two months.

Burlington, Cedar Rapids & Northern.—Kimball & McNamara of Sioux City, Ia., the contractors of the Forest City extension have sublet most of the work, and the sub-contractors for the grading are at work at several points along the line. The tracklaying will be commenced about the middle of July, and the headquarters of the contractors will be at Forest City, Ia. The grading is light prairie work averaging about 12,000 cu. yds. to the mile. The contract of Kimball & McNamara begins at Forest City and extends to a point about 20 miles east of Estherville. The contract for building the line into Estherville on the Iowa Falls division will probably be let in a few weeks. A company called the Chicago & Iowa Western has been organized to build the line. The route is northwest from Forest City for about 10 miles and thence nearly due west for 55 miles through the counties of Winnebago, Kossuth and Emmet to Estherville.

Charleroi & Belle Vernon.—The charter filed in Pennsylvania last week authorizes the construction of a road from a point on the line of the Pittsburgh, Virginia & Charleston in Charleroi, Washington County, to a point on McKeesport & Belle Vernon, three miles. The capital stock is $30,000. W. D. Hortupee, of Charleroi, Pa., is President.

Chicago & West Michigan.—The Petoskey extension will probably be opened its entire length on June 26. The extension begins at Traverse City, on the main line, and extends north along the shore of Lake Michigan to Petoskey, Mich., a distance of 77 miles. About 50 miles of the track was laid last year, and the balance of the track has now been laid. A branch is being built from this line near Charlevoix, to Ironton, four miles.

Clearfield & Mahoning.—George S. Good & Co., of Lock Haven, Pa., have secured the contract for building 16 miles of this extension of the Buffalo, Rochester & Pittsburgh, to connect with the Beech Creek road at Clearfield, Pa. The work has already been commenced and will be pushed vigorously. Their contract extends from Clearfield along the Susquehanna River and Anderson Creek. Collins, Broadhead & Shields have the contract for the balance of the road west to Du Bois, 14 miles.

Clermont & Marvin Creek.—This company was incorporated in Pennsylvania last week to build a road through McKean County, five miles from Clermont, to a point on Marvin Creek, intersecting with the Mount Jewett & Smethport Railroad, incorporated last week. Thomas C. Wainman, Eldred, Pa., is President.

College Hill Marginal.—This proposed road is to be three miles long, beginning at Beaver Falls, near the works of Carnegie, Phipps & Co., and extending through Beaver Falls, College Hill and White Township to the Pittsburgh & Lake Erie, near the mouth of Wallace Run. The capital is $30,000. John C. Whitla, of Beaver Falls, is President.

Columbia & Puget Sound.—The Oregon Improvement Co. is making a survey for a new branch of the road to leave the present line at Maple Valley, Wash., and extend about six miles east to a section where valuable mineral discoveries are reported to have been made.

Columbus Belt & Terminal.—The route of this road, chartered last week, is from a point near the intersection of Broad street and Alum Creek, Columbus, O., and thence northwest across High street and southwest to a point near the intersection of Broad street and Skidmore street, thence south and east, and finally north to the starting point. Among the incorporators are: H. Sabine, S. E. Jones and Joseph Guitner, all of Columbus, O.

Columbus, Shawnee & Hocking.—A branch about 1½ miles long will probably be built from the main line near New Salem, O., north to a pleasure resort near the reservoir in Licking County. Dummy trains will be run over the branch.

Concord Southern.—The County Commissioners have been petitioned to order an election at Wadesboro, N. C., to vote on the question of voting $25,000 for the line. About $125,000 has already been raised in Cabarrus County to be used in the construction of the new road. Concord voted $75,000; Mt. Pleasant, $25,000, and $25,000 has been raised from other sources. Elections for about $45,000 of subscriptions have been ordered in various townships. W. M. Smith, of Concord, has just made an examination of the country between Concord and Wadesboro, passing through Mt. Pleasant, Big Lick, Foreman's Mill, Crump's Mill, where Rocky River is crossed, and to Ansonville and Wadesboro. The distance is 58 miles. There are two routes under consideration, one to Monroe and the other to Wadesboro. The distance to Monroe by the route surveyed is 32 miles. J. M. Odell, of Concord, N. C., is President.

Denver & El Paso Independent.—A charter for this company was applied for in New Mexico last week. The company has already been incorporated in Colorado to build south to El Paso, the line through New Mexico being via the towns of Las Vegas and White Oaks. Jefferson Raynolds, of Las Vegas, is the chief incorporator of the New Mexico division.

Fair Hill.—The new freight branch into the Kensington district near Philadelphia was chartered this week under this name. The road will extend from a point on the connecting road between Fillmore street and Hart lane, in the Thirty-second Ward, Philadelphia, then southwardly to Cambria street. J. N. Du Barry is President.

Florida Coast & Gulf.—The company was recently chartered in Florida to build a road from the west side of the St. John's River, near Jacksonville, to the Gulf of Mexico, near Tampa, a distance of about 325 miles. The capital stoek is $1,000,000.

Florida-Key West Railway & Bridge Co.—This company has been chartered by Charles Delano, of Glenwood, Fla.; Sewell P. Hays and Isaac A. Stewart, of De Land, Fla. The road is to extend through Monroe and Dade counties, and will be 175 miles long. The capital stock is $100,000.

Goderich & Wingham.—The Dominion Government has promised a subsidy to assist in the completion of this road, projected from Goderich to Wingham, Ont., 23 miles.

Gouverneur & Oswegatchie.—Grading was begun June 13 by S. V. R. Hendrick, of Richville, N. Y., who has the sub-contract for three miles from Hallesboro to Emeryville. Contracts for building other portions of the road will be let this week by Moffett, Hodgkins & Clarke. The road will afford an outlet for the pulp and and talc mills along the Oswegatchie River, between Gouverneur and Edwards, N. Y., 15 miles. It will also afford access to seldom frequented portions of the North woods.

Grand Trunk.—The estimated cost of the extension between Kingscourt and Glencoe, Ont., 22 miles, is $400,000. The two large steel bridges, one at Alvensten and the other at the south of the village, will be the most expensive part of the work.

Great Northern.—About July 1 the company will commence running trains into Spokane, Wash., and it is probable that at the same time through trains from St. Paul to the Pacific Coast, in connection with the Union Pacific, will be put on. Negotiations are pending and the arrangements are practically completed.

Engineer Miller while at Huron, S. D., last week is reported to have expressed the opinion that the company might build this summer an extension of the Duluth, Watertown & Pacific from Huron south toward the Missouri River.

Iron Range & Huron Bay.—The track laying on this road in the northern Peninsula of Michigan will begin in July, when the grading that now remains to be done will be completed. The road is being built from a point on Huron Bay near Arvon, southeast to Champion, Mich., 35 miles. The traffic will be mainly iron ore from the mines near Champion and timber, the road passing through a heavily timbered country. The rails will weigh 70 lbs. M. Lally, of Detroit, is the contractor for the grading. A merchandise dock at Huron Bay has been finished, and an ore dock is now being built by T. H. Hamilton, of Toledo, O. Sanford Keeler is the Superintendent, and E. Miller is Chief Engineer, both with headquarters at Arvon.

Jacksonville, St. Augustine & Halifax River.—S. J. Fox, of Volusia, Fla., has, it is stated, been awarded the contract to grade the extension from Daytona south to New Smyrna, Fla., a distance of 16 miles.

Jacksonville Southeastern.—The locating survey for the extension from Havana, on the Illinois River, to Rock Island, has only been made for about 15 miles, to Canton, north of Havana. D. M. Collins, of Kirksville, Mo., has the contract for this section, and he has a large force doing the grading. Surveys have been made for several lines north of Canton, and the route will probably be selected in about 30 days.

Jalisco Pacific.—First mortgage six per cent. bonds to the amount of $25,000 per mile of completed road have been issued, the trustee under the mortgage being the State Trust Co., of New York. The principal and interest is guaranteed by the Mexican National Construction Co. The length of the road when completed will be 225 miles from the Pacific coast to Guadalajara, Mex. The surveys are complete, and the contracts are in the hands of the Mexican National Construction Co. Fifty-nine miles of the road is already completed and in operation from Colima, Mex. H. H. Filley, of Kansas City, will be Engineer-in-chief.

Kansas City & New Orleans.—An amended charter was secured in Texas last week authorizing several new lines, with an aggregate mileage of 120 miles. One line is to be from near Bassett to Dalby Springs and Clarksville, 35 miles, and from Bassett to Atlanta, Cass County, east to the state line and north to Texarkana. W. G. Disborough, of Dallas, Tex., is President, and Gen. Hugh Stewart is Chief Engineer, and Capt. D. A. Poyner, of Dallas, is Consulting Engineer.

Kingston, Napanee & Western.—Work will begin in a short time on the extension from Harrowsmith, about 19 miles from Kingston, west to Lake Sydenham, Ont., about 10 miles.

Kishacoquillas Valley.—This road is to be built from Reedsville to Bellsville, Pa., nine miles, through Mifflin County. The capital stock is $100,000. Samuel Watts, Bellsville, Pa., is President.

A charter was granted at the State Department, at Harrisburg, Pa., this week, to this company. The line will be nine miles long in Mifflin County. The capital stock is $100,000.

Mahoning Valley.—A contract has recently been made with the Buffalo, Rochester & Pittsburgh by which the Rochester & Pittsburgh Coal & Iron Co. is to handle all the coal mined at the Helvetia mines on this road. It is also stated that the contract provides that the road shall be extended to a connection with the Beech Creek road, and that it will then be operated by the Buffalo, Rochester & Pittsburgh.

Mason City & Ft. Dodge.—Mason City, Ia., has been asked to vote a two per cent. tax in favor of this company for a line north of Manly Junction to Mason City, about 10 miles. The surveys have been made to connect with the Chicago, St. Paul & Kansas City at the latter point, and it is reported that right of way has been secured for part of the distance.

Mexican & Central American.—All work on the line has been stopped suddenly. The line is projected from Vera Cruz to a junction with the Tehuantepec road, and a prospectus was recently issued in London calling for stock subscriptions. The relief engineer, James A. Hill, has left Mexico for London.

Mexican Northern Pacific.—The company recently organized in England to build this line is reported to have secured all the funds necessary to complete the road. Tracklaying will begin south of Deming, N. M., as soon as the rails which are now being rolled in England are delivered at that town. The surveys of the entire system have been made, and it is proposed to begin active construction work near Deming at once, and rapidly push the work south of that point into northern Mexico. The general contract for building the road and furnishing material has been let to Huss, Townsend & Co., of The Rookery Building, Chicago, Ill. The firm is composed of George M. Huss and George Townsend. The route is from Deming, N. M., southward to Guerrero, a point about 150 miles west of the city of Chihuahua, Mex., and thence eastward to Chihuahua and southwest to Topolobampo, on the Pacific Coast, and northward to Guaymas, an approximate distance of 1,200 miles. The line is designed to open up the mining regions of the Sierra Madre, a large area of pine and oak timber lands, and the agricultural and grazing plains and valleys now without transportation facilities. The general character of the work is light, the line following the river valleys with easy grades and good alignment, though there is a section of about 100 miles where the Sierra Madre range is crossed that will be heavy mountain work. The general maximum grades will be one per cent. and the curves six degrees, though in the mountains a maximum of 3½ per cent. grades and 15 degree curves will be used. William Martineau is Resident Engineer.

Mexican Western.—The concession for this road has been approved by the Mexican Congress. The concession was granted to Albert K. Owen by President Diaz last winter. The road will extend from Topolobampo, Sinaloa, to Presidio del Norte, on the Rio Grande, from 650 to 700 miles. There is a large land subsidy attached to the concession.

Michoacan Southwestern.—The maps and plans submitted by Messrs. Dennie and Marshall for the construction of this road have been approved by the Department of Public Works. Work will be commenced this month.

Middle Georgia & Atlantic.—The company has executed a mortgage for $376,000 on the completed portion of its road from Machen to Eatonton, Ga., to obtain funds for construction purposes. The company, it is again reported, expects soon to resume the building of its road to Savannah.

Milwaukee & Northern.—McIntosh Bros. have been awarded the contract for building a line about 50 miles long connecting the main line of this road with the southern terminus of the Ontonagon & Brule River branch, which will complete a new route through the upper peninsula of Michigan to Lake Superior. The new line begins near Sagola, 20 miles north of Iron Mountain, and extends northwesterly to Sidnaw, Mich. The headquarters of the contractors will be at Crystal Lake, and they will sublet the work at that point immediately. Twelve hundred men will be at work on the line before July 1, and it is to be completed by November. It will traverse an unsettled and densely timbered district crossing the Michigamme, Perch, Net and Hemlock rivers. The grading will average from 15,000 to 17,000 cu. yds. of earth to the mile.

Minneapolis, St. Paul & Sault Ste. Marie.—Fifteen miles have been added to the contract of A. H. Linton & Co., of Minneapolis, making 40 miles under construction. Bids have been received for 35 miles more of the same extension northwest from Valley City, N. D.

Missouri, Kansas & Texas.—It seems that the amended charter filed in Texas last week authorizing various extensions included two lines not noticed last week. One is the long projected extension for the main

line from Baggy Tank to Houston, and the second is from a point on this line near Patterson southeast to Velasco, a deep-water harbor on the Gulf of Mexico, south to Galveston.

Monterey & Mexican Gulf.—An engineering corps in the employ of the company has started from Treviño, the northern terminus of the road, under the direction of Engineer Turner, to locate the extension to the Sierra Mojada Mountains, Mex. Right of way for the extension is being secured.

Natchitoches.—The company will hold a stockholders' meeting on June 17 to consider the extension of the road from Natchitoches to a point on the Red River near Grand Ecore. Leopold Caspari, of Natchitoches, is President.

New Iberia & Vermilion.—The local right of way committee announces that it has purchased all the right of way to the Vermilion River which was not donated by the owners. The Southern Pacific is now expected to begin work at once at Abbeville, La., and complete the 15 miles of road in three months.

New Roads.—It is stated that the Butter's & Peter's Salt & Lumber Co. will extend its narrow gauge logging road to Newaygo or White Cloud, Mich., and open the line for passenger traffic.

A "mass meeting" was held June 9 at the new co-operative town, 22 miles from Bristol, Tenn., to discuss the feasibility and to propose plans for the construction of a road from Asheville, N. C., to Elizabethtown, where it will connect with the Bristol, Elizabethtown & North Carolina road. By constructing this road the distance from Asheville to the north via the Norfolk & Western and the South Atlantic & Ohio would be greatly shortened. It is about 190 miles from Bristol to Asheville via Morristown. The distance via the new route will be shortened at least 100 miles.

The project of connecting Neihart and Castle, Mont., by rail, has been abandoned on account of the engineering difficulties, says a Great Falls paper. It was found that a three per cent. grade would be needed, and the tortuous course and numerous cuts and trestles on account of the coulees would be very expensive. This does not mean any abandonment, it says, of the scheme to connect Castle with Great Falls. The engineers have already been making surveys of other routes.

Another survey of the proposed link between St. Clairsville junction and Valley junction in the northern part of Tuscarawas County in eastern Ohio will be soon made.

Engineers are surveying a road which, with connecting steamers, would make a through route from the Chelan mining district to the Upper Skagit River and open the Cascade mining district. D. C. Corbin, President of the Spokane & Northern, is said to be interested. The proposal is to build a railroad from the terminus of the Washington Central at Coulee City, Wash., to the Columbia River, opposite the foot of Lake Chelan. Steamers would run up the lake and down the Columbia to Wenatchee, where they would connect with the Great Northern. Another road is projected by the same parties from the head of Lake Chelan through the Cascade pass, and down the Cascade and Skagit rivers.

New York, New Haven & Hartford.—It is announced that the directors, at their regular monthly meeting last week, voted to lay third and fourth main tracks from New Haven westward, 10 miles, to Milford, and from New Rochelle westward, three miles, to Mount Vernon. With these additions, the main line of the New York division will be a four-track road for more than half its length, as follows: New Haven to Milford, 10 miles, four-track; Milford to West Bridgeport, 9 miles, double track; West Bridgeport to East Norwalk, 12 miles, four-track; East Norwalk to Port Chester, 16 miles, two-track; Port Chester to Mount Vernon, 12 miles, four-track. The work now laid out probably includes also the 1¼ miles west of Mount Vernon to the connection with the New York Central tracks at Woodlawn. The tracks at this junction have already been rearranged, as shown in the *Railroad Gazette* of June 3. Work has also been begun at Mount Vernon, where a large freight yard is to be made. An overhead bridge about 180 ft. long, to carry a street across this yard, is already nearly completed. The work west of New Rochelle will be quite heavy, as the present grades are very unfavorable, and there is a good deal of rock cutting. This four-mile section of the line has practically no freight traffic, as all the freight to and from New York City is carried over the Harlem River branch, which leaves the main line at New Rochelle. This branch will probably be made four-track before long, as there are now 22 passenger trains over it each way daily, besides a heavy freight traffic. The newspapers state that the company has already purchased a great many parcels of real estate in preparation for the four-tracking here. It is given out that the company has practically decided to complete the four-tracking of the main line of the whole New York division as soon as the work can be conveniently done, and that this decision has been arrived at in consequence of the acquisition by the company of the lines of the Housatonic Railroad system, as reported in another column of this paper.

Norfolk, Wilmington & Charleston.—The companies organized under State charters in Virginia, North and South Carolina, to build sections of the route between Norfolk and Charleston and Columbia have been consolidated in one corporation. At a meeting of the Board of Directors on June 8 the contracts made by the several companies before consolidation with the Carolina Construction Co. were confirmed by the new company. It was decided to at once draw up the mortgage papers, and issue the mortgage to the amount of $6,000,000 on the main line of the road between Norfolk and Charleston. It is expected that construction will be begun within a short time. C. H. McKibbin, of Philadelphia, is General Manager.

Orford Mountain.—This road is to be extended the present summer from Lawrenceville to Kingsbury, Que., a distance of ten miles, and the contract has been let to C. C. Smith & Co. Judge J. W. Foster, of Montreal, is President and General Manager.

Parry Sound Colonization.—The second 10 miles of this road west of Emsdale, Ont., has been completed and inspected by the Engineers. Thomas Ridout for the Dominion, and Robert McCallum for the Ontario Government. This line is now open from the junction with the Grand Trunk at Scotia, Ont., to Bear Lake, leaving about 28 miles of the road to be built to reach Parry Sound.

Pennsylvania.—The Philadelphia Councils have been asked to grant the company right of way for a short freight branch to reach the Kensington mill district. The proposed branch begins between Rose Hill and Ormes street, and runs in a straight line to Indiana and Ormes streets, where a freight house will be built. All the right of way has been secured, and a company called the Fair Hill Railroad has been chartered to build the road.

The local papers announce the opening of a branch of the Pennsylvania Schuylkill Valley road from Pottsville west to Minersville, Pa., a distance of about five miles. The new line opens up a rich coal region.

Pere Marquette & Big Rapids.—A charter for this company was filed in Michigan last week, the capital stock being $360,000, and the principal office is at Ludington, Mich. The route of the new road appears to be the same as that of the road organized by Thomas McMasters, of Ludington, from Ludington, on Lake Michigan, to Big Rapids.

Peterborough & Sault Ste. Marie.—This line which has been promised a subsidy by the Dominion Government, will start from a point on Lake Ontario, and will go by way of Peterborourgh, Lakefield, Young's Point and Babcaygeon to Sault Ste. Marie. James Stevenson, M. P., John Burnham, M. P., Thomas Cahill, R. S. Davison, H. W. Moore, J. R. Stratton, M. P. P., E. H. D. Hall and R. A. Morrow are the promoters.

Philadelphia & Reading.—Surveys have been made for a branch of the Schuylkill Valley division to connect with the foundries and factories on the Schuylkill River near Royersford, and work is to begin at once. The branch will be only a mile long, beginning at Spring City, near Norristown, and extending to Royersford, but with the bridges over the river between the two towns will probably cost $100,000 to construct.

Pittsburgh & Lake Erie.—The track south of Youngstown, O., is being relaid with 80-lb. rails between Youngstown and Carbon, about 10 miles, and from Edenburgh, a few miles beyond Carbon, to Newport, the second station south of New Castle Junction and about 23 miles beyond Youngstown.

Portland & Rumford Falls.—The track on the Rumford Falls extension was laid into the town last week, about one month ahead of the contract time. The extension is 15 miles long, beginning at Gilbertville on the main line, and extending along the Androscoggin River to Rumford Falls. A number of large pulp mills, saw mills, etc., have been started at the latter town, which has an excellent water power, since the new line was begun. Freight is already being sent over the new road, and passenger trains will be run as soon as the ballasting is finished. The grading has begun on an additional 1¼ miles of road near the falls by the contractors Mitchell & Spofford, which will be finished by July 1.

Rockaway Valley.—The track on the Morristown extension has been laid to Brookside, N. J., and about 100 men are working between that town and Morristown, N. J. Superintendent Melick expects to run a train into Morristown by July 4, and to have the extension in regular operation by Sept. 1. The only heavy work remaining to be done is at Speedwell Lake, near Morristown. The Morristown extension is being built more solidly than the old line from Peapack to Mendham.

Rockport & Harbor Island.—The survey has been commenced under Engineer Hitchcock for this suburban road to extend from Rockport to Harbor Island in Aransas Bay. The length of the line is variously given as nine and as 20 miles. The company was incorporated last April by George Gurley, of Rockport, Tex., and others.

Rio Grande Southern.—The branches to the Ute Coal & Coke Co.'s mines and the branch to the Porter mine, near Hesperus, Col., two miles and three-quarters of a mile, respectively, are all graded and the track is nearly laid. Work will soon commence upon a spur at Rico, Col., to the Black Hawk and to the Group tunnel. This will be a switchback line, with five per cent. grades, 20 deg. curves, about three and one-half miles long, and will have four switchbacks. Surveys on the main line have been made down the Mancos and San Juan rivers from Mancos to the Colorado-Utah line. The maximum grades are 1.8 per cent., and maximum curves 8 deg., with good alignment and few curves. Surveys are now in progress from Dolores down Havenweep and McElmo creeks to the San Juan River. One or both lines will be commenced this season. C. W. Gibbs, of Ridgway, Col., is Chief Engineer.

St. Lawrence.—The company will make application to the Quebec Legislature, at its next session, for an act of incorporation with power to construct a road from the Village of St. Lambert, in the County of Chambly, to the City of Sorel, in the County of Richelieu. E. A. D. Morgan of Montreal is solicitor for the incorporators.

Slackwater Connecting.—This new road is to be one mile long, and will be a branch of the Baltimore & Ohio from a point on its Pittsburgh & Connellsville Division in Braddock township to a point on the Monongahela River in Rankin Borough. H. C. Fownes, of Allegheny, is President.

Southern Pacific.—About 100 miles of road on the Sacramento division beginning at Roseville, Tex., about 20 miles from Sacramento, and extending to Truckee is now being relaid with 76-lb. rails to replace the 60-lb. rails now in the track. The company will begin to lay the new rails in a few days, and it is expected that the work will be completed in the fall. It was decided to relay the division with heavier rails when the order was given to the Schenectady Works for 27 new heavy compound engines. The new engines will be used on the Salt Lake division until the relaying of the track on the Sacramento division is finished.

Texas & Oregon.—This name, it appears, is the correct title of the road heretofore referred to as the Cammal & English Centre. The name at once suggests some transcontinental project, but it only means that in the vicinity there is an Oregon hill and a place called Texas, so the road was given the big name. It is being built from Cammal about eight miles in the direction of English Centre, but it does not go to that town. Construction work is now going on at Cammal, and some track has been laid, 60-lb. rails being used. The grades are very heavy and the curves sharp. The principal object of the line is to reach the timber on the top of the mountains, and it is being built by C. E. Titman, of Shenandoah, Pa.

Trenton Cut-Off.—The double-track work on this division of the Pennsylvania is making rapid progress, and will soon be completed between the Delaware and Schuylkill rivers. The new bridge across the Delaware at Morrisville has just been opened to travel, and extensive improvements are being made near that point at the intersection of the cut-off with the main line.

Trinidad & San Luis Valley.—The local committee at Trinidad, Col., in charge of preliminary work, has completed arrangements for an immediate survey of the line. J. R. De Remer, the contractor, is ready to commence construction work.

Unaka & Nola Chucky.—The right of way is now being secured south of Morristown, Tenn., for this new road, which is to extend through Eastern Tennessee. The surveys have been made for the entire line, from Morristown to Embreeville, and the officers expect to let the contracts and have the work begin about Sept. 1. The grades and curves are favorable on the entire line, and the route is through a good agricultural country and timber district and also reaches the iron mines in the Cranberry region. R. A. Bowie, of Greenville, Tenn., is Chief Engineer.

Williams Valley.—The ballasting on this road will be completed to Lykens, Pa., in a week, and then the entire road will be ready for operation. The grading and tracklaying were recently finished. The road begins at Brookside, Pa., and extends 1½ miles east, where a switchback has been built. The route is then west through Schuylkill County, via Tower City, 1½ miles from the switchback, and Williamstown 4½ miles from Tower City, to Lykens on the Summit branch of the Pennsylvania and 12 miles from Brookside. The contractor for the road is Col. John Jameson, of Bloomsburg, Pa. Carroll R. Williams, of 608 Chestnut street, Philadelphia, is President, and Hammond Carr, of Tower City, is Chief Engineer.

Winnipeg & Hudson Bay.—Armstrong & Co., of Broad street, London, are reported to be at the head of a syndicate organized in England to build this road, as reported last week. The news from England is that the bankers have underwritten the bonds and that the construction of the line to the Saskatchewan River is an assured fact. Ross, Mann & Holt are to be the contractors, and it is said work will be commenced before the autumn.

Wood Mountain Qu'Appelle.—It is reported that the so-called Brassy Company has secured possession of this charter, and will build the section between Qu'Appelle Station and Fort Qu'Appelle, Can., this summer.

Yankton, Norfolk & Southwestern.—Larson & Co., of Michigan, are reported in the local papers to have the contract for building 30 miles of the line between Yankton, S. D., and Norfolk, Neb.

GENERAL RAILROAD NEWS.

Chattanooga Southern.—The United States Court at Atlanta, Ga., has issued an order for the sale of this road at Atlanta at a date to be fixed by the Receiver. The decree was issued in the suit of the Central Trust Co., of New York, and Elias Summerfield against the railroad. The trust company is the trustee of the first mortgage six per cent. bonds, amounting to $1,140,000.

Cincinnati, Hamilton & Dayton.—A mortgage for $3,000,000, covering real estate, rolling stock and other property, was filed at Cincinnati last week. The mortgage is in favor of the American Trust Co., of New York.

Duluth, Red Wing & Southern.—The press dispatch, published some weeks ago, stating that this road would be sold this month under a judgment for $28,000, proves to have been entirely erroneous. The claim was one that had been contested in the courts, and when final judgment was given it was promptly settled.

Duluth Transfer.—A mortgage for $2,000,000, made in favor of the Metropolitan Trust Co., of New York, was filed at Duluth last week, the bonds to bear six per cent. interest. The company has been organized to furnish terminal facilities to the manufactories on the northern side of the Bay of St. Louis and for the railroads reaching the head of Lake Superior at Duluth and West Superior. The main line will be about 20 miles long, with spurs to all the factories. Several miles of the road in West Duluth is now in operation and the balance of the line to Duluth is under contract.

Great Northern.—The following is the report of earnings for May:

Month of May:	1892.	1891.	Inc. or dec.	
Eastern of Minn	$83,233	$114,417	D.	$31,184
Montana Central	114,933	132,628	D.	17,694
St. P., M. & M. leased lines.	794,103	777,912	I.	16,091
Total for system	$992,169	$1,024,956	D.	$32,787
For 11 months to May 31:				
Eastern of Minn	$1,137,51	$728,958	I.	$408,293
Montana Central	1,132,262	1,166,500	D.	34,238
St. P., M. & M. leased lines.	12,046,751	9,746,112	I.	2,300,669
Total for system	$14,316,264	$11,635,600	I.	$2,680,664

Housatonic.—The sale of a large majority of the capital stock of the company to J. Pierpont Morgan and William Rockefeller was announced last Saturday. The stock was owned by William Starbuck and his friends. Mr. Rockefeller and Mr. Morgan are directors of the New York, New Haven & Hartford, and it is thought by many that they are acting for that company. The main line extends from Bridgeport to Pittsfield, Mass., passing through Lenox, to which point the summer travel is large and profitable, and taking the traffic of Western Massachusetts to the shore of the Sound whence it has heretofore reached New York by water lines. The New Haven road may take this traffic through without transfer. The length of this line is 111 miles, but operated mileage is 192 miles. The branches are the Danbury & Norwalk, 27 miles; the State Line Branch, 11 miles; the Brookfield Branch, 6 miles; the Hawleyville Branch, 6 miles; the Ridgefield Branch, 4 miles, and the New Haven & Derby, 27 miles. The purchase includes also the very valuable terminal properties at Bridgeport, and New Haven, and the transaction may lead to the purchase of the Wilson Point property at Norwalk, now used by the Housatonic for the transfer of freight to boats. The Housatonic has for some time been used by the New England as an outlet to Long Island Sound for its system. Mr. Starbuck, who is a director of the New York & New England, says: "The relations of the Housatonic with the New England have been very close, but there has only been a traffic agreement between them which can be terminated at any time." Another director says the contract is for 20 years of which only two or three years have expired.

The New Haven reporter of the New York *Evening Post* says: Just before Mr. Starbuck and what was known as the "Standard Oil" group bought the common stock about seven years since, the road was offered by the larger holders to the New Haven Co., and it is stated that only a matter of some $40,000 stood in the way of an agreement as to price. But the conserva-

tive President Watros of the New Haven stood out, and the road went to Mr. Starbuck and his friends. Had the sale been made to the New Haven Co. then it would have saved the latter a large amount, especially if we include the price now probably paid to secure control. But the road went to the representatives of a hostile interest, who immediately, as controllers also of the New England system, began a regular campaign against the New Haven Company. They bought from the city of New Haven control of the Derby Road, and extended it to the Housatonic, obtaining thus a new outlet to the West from New Haven. The Danbury & Norwalk was leased with its Hawleyville Branch, the Wilson Point improvement scheme giving steamboat connection with New York city carried through, traffic arrangements made with the New England, and the two roads brought into close working connection. In 1889 came the great "parallel" fight based upon a scheme to authorize the Housatonic to build branches paralleling the New Haven Co.'s main line and looking to an ultimate entrance to New York City. The legislative scandals of that corrupt contest, which cost the rival companies probably not less than $300,000, are still fresh in the memory of Connecticut citizens, and will always be most unsavory. The Housatonic-New England combination failed in the Legislature, but it nevertheless, by its competitions, has been a sharp thorn in the side of its prosperous rival.

Illinois Central.—The earnings for the 10 months ending April 30, 1892 and 1891, were as follows:

	1892.	1891.	Inc.
Miles operated	2,888	2 875	13
Gross earnings	$15,227,582	$15,046,656	$1,180,926
Oper. expen. and taxes	11,660,828	10,533,825	1,127,003
Net earnings	$4,566,754	$4,512,831	$53,923

The gross receipts from traffic for the month of May, 1892, are estimated at $1,448,658, and for May, 1891, the receipts were $1,423,573, the estimated increase being $25,085.

Morristown & Cumberland Gap.—The Receiver's control of this road did not last more than 24 hours. When the appointment of the Receiver under the suit brought against the railroad and the contractors was announced, the company filed bonds to cover the amount of the alleged indebtedness, and the Receiver was immediately discharged.

New York & New England.—An effort is being made by the present management to retain its control of the company for five years by the establishment of a voting trust. It is proposed that the stockholders shall deposit their stock with the Farmers' Loan & Trust Co., of New York, which will issue for it trust certificates that will take its place in all save the voting power.

A traffic arrangement is announced between this company and the Reading road for the exchange of traffic via the Poughkeepsie Bridge.

North American Co.—This company, which was organized about two years ago by Mr. Henry Villard as the successor of the Oregon & Transcontinental Co., held its annual meeting at Newark last week. The Board of Directors is classified and Thomas J. Oakes, J. H. Herrick and Silas W. Burt were elected for three years. President Villard's report shows that the company owns about $8,860,000 of Northern Pacific and Chicago & Northern Pacific stocks and bonds, $6,800,000 of street railroad securities and $216,000 of Edison General Electric stock. The net assets are $7,871,600. The income account for the year ended May 31 shows a net cash income of $146,873.

President Villard referred to the investigations made for the company, as to the praticability of using electricity as the motive power on steam roads. These investigations have been carried on both in this country and in Europe, and have sufficiently advanced to warrant the announcement that practical experiments with electrical locomotives will be undertaken during the current fiscal year. For that purpose the company has secured the co-operation of the General Electric Co. and of the General Electricity Co., of Berlin, Germany. Two different systems, with both overhead and surface conductors, the latter devised by the last mentioned company, will be tried. The North American Co. will have the exclusive right of exploiting the surface system in this country.

Northern Pacific.—The company reports sit earnings, including those of the Wisconsin Central system, for April as follows:

	1892.	1891.	Inc. or dec.
Gross earn	$2,192,520	$2,309,878	D. $117,358
Oper. exp	1,306,437	1,405,256	D. 98,818
Net earn	$886,082	$904,622	D. $18,540
Other income	194.120	163,888	I. 30,232
Total income	$1,080,203	$1,068,511	I. $11,692
Int. rent. taxes	1,139,152	1,025,716	I. 113,436
Surplus	$58,949	def. $42.794	I. $101,743

The preferred stock outstanding is $36,306,250, or $132,244 less than last year, and the funded debt is $122,469,500, $4,333,000 greater. The net earnings of the Winconsin Central road for the month were $135,468, against $155,638 last year. The two companies report for ten months of the fiscal year:

Gross earn	$25,462,596	$25,881,416	D. $419,120
Op. expenses	15,026,936	15,278,043	D. 251,107
Net earnings	$10,435,360	$10,603,373	D. $168,013
Other income	1.569,012	1.010,135	I. 558,877
Total income	$12,004,372	$11.613.508	I. $390,864
Fixed charges	11,054,220	10.114,900	I. 939,320
Surplus	$950 152	$1,498,608	D. $548,456
On pref. stock	2.59 p. c.	4.08	D. 1.49

Ohio & Mississippi.—The United States Circuit Court at Cincinnati has decided the suit relative to the legality of a stock vote of the railroad, by which new directors representing the Baltimore & Ohio interests were elected, in favor of the legality of the vote. The directors who refused to vacate their offices, denying the validity of the vote of the stock held by Brown, Shipley & Co., of London, are therefore ousted. The Baltimore & Ohio directors, in whose favor the suit is decided, are S. S. McKim and D. Fahnestock, of Baltimore, and Julius S. Walsh. The board of directors of the company consists of members elected three each year and four every fourth year. The Baltimore & Ohio interest is still four short of a majority. Three directors will be elected next October, and at the election in 1893, when four directors will be elected, the Baltimore & Ohio will probably obtain a majority of directors in the Ohio & Mississippi, who will carry out the contemplated plan.

Pennsylvania.—A large amount of work is being done toward the enlargement of the Broad street station in Philadelphia, including the main tracks of the approaches, which are carried upon a masonry viaduct from the Schuylkill River eastward to the station at Fifteenth street. The plans for enlarging the station house itself are still unsettled, and nothing has been done toward changing that part of the premises; but the preparations for widening the train shed, and for laying an additional main track westward as far as Twenty-first street, are actively in progress. The first move is to get rid of the buildings on the south side, occupied by the express company, and to this end a number of old buildings further away from the track are now being demolished, to make way for a new building for the express company.

St. Cloud Sugar Belt.—This road is hereafter to be operated by the South Florida Railroad, to which it was leased on June 1. The road is 14 miles long, extending from Kissimmee on the South Florida west to Narcoossee, and was built in 1888 and 1889. The capital stock and funded debt are each $120,000.

San Antonio & Aransas Pass.—A supplemental decree has been issued for the sale of this road, previously set for Nov. 1. The entire property is to be sold, and the reserved price is $12,000,000. The court orders that all questions of law between the intervenors and all other parties, and all orders as to the appropriation of the proceeds arising from the sale be reserved for consideration until the confirmation of the report of sale. This order is made because of the separate suits now being tried for the removal of each of the two receivers.

South Carolina.—The United States Court at Charleston, S. C., issued an order this week for the sale of all the property of the company at Charleston, Nov. 17, and it is not thought that an appeal from the decision will be taken. The order was issued in the suit of F. W. Bond and others against the company. The Receiver was appointed in October, 1889, on account of a default in the interest on the second mortgage bonds, and since the appointment he has paid part interest on the bonds.

Tennessee Midland.—The company filed at Memphis last week a mortgage in favor of the St. Louis Trust Co. to secure first and second mortgage bonds to the amount of $2,700,000. The principal purpose is to raise money to pay for the extension of the road east of the Tennessee River.

Wheeling & Lake Erie.—The stockholders will meet July 7 to vote on the issue of $8,000,000 consolidated four per cent. bonds. Of these there will be set aside $6,400,000 to retire outstanding bonds. Four million common stock is likewise to be issued to buy equipment, enlarge Wheeling terminals, etc. It is not intended to issue this stock for some time. The directors, in a circular issued to the stockholders, declare that the recently completed extensions of the line to the Pittsburgh coal regions and the Ohio River put a severe strain on the company's resources, although the new traffic already developed shows that the effort was fully justified. Since the completion of the Wheeling extension there has been an increase of 44.65 per cent. in the passenger mileage and 56.55 per cent in the tonnage movement, against practically stationary traffic returns previously. Out of 1,607,487 tons of freight moved in 1891, 1,007,273 tons consisted of bituminous coal. In the conduct of this business it is necessary to extend credit on the carrying charges, which aggregate a large amount, and therefore the company is forced to borrow money to defray the road's obligations. It is proposed to issue consolidated four per cent. bonds to take up, as they become due, $3,000,000 bonds on the Lake Erie division, $1,500,000 on the Wheeling division, $1,400,000 extension and improvement bonds and $500,000 Belt Railway bonds, making $6,400,000 in all. Of the $1,600,000 remaining the company will use $600,000 at once to discharge bills payable created against freight earnings and to provide working capital. The remaining $1,000,000 bonds will be used only as authorized for the acquirement of property.

Winslow & Richland.—The road was opened for traffic on June 11 and will be operated by the West Jersey road. It extends from Winslow Junction to Richland Junction, N. J., a distance of 11.44 miles, and the Richland & St. Petersburg extends from Richland Junction connecting with the West Jersey to Petersburg, a distance of 18.83 miles. Five stations will be established on the Winslow & Richland Railroad and eight on the Richland & Petersburg. These roads comprise the greater portion of the Philadelphia & Seashore road, which was recently purchased by the Pennsylvania.

TRAFFIC.

Chicago Traffic Matters.

CHICAGO, June 15, 1892.

The other trans-continental lines seem to have induced the Atchison to withhold action on second class rates to Pacific coast points, which it had proposed reducing today. The Atchison's condition is that the presidents shall determine upon a commission agreement at the meeting of the Advisory Board next month and put the same into effect without delay. The agreement drafted at the last meeting failed to materialize when submitted for signatures, a number of the presidents professing to find weak spots in it which they were afraid would not sufficiently protect their business. President Cable, of the Rock Island, said that the Southern Pacific maintains agents in Europe who have authority to pay any commissions necessary to secure the business, and therefore other roads cannot compete with it with only the authorized commission to offer on this side of the ocean. President Clark, of the Union Pacific, declined to sign, because of the Northern Pacific's contracts with A. E. Johnson & Co., emigrant agents, which can not be canceled without the consent of both parties; and President Jeffery, of the Denver & Rio Grande, could not enter into the agreement because the Central Pacific will not consent to pay its proportion of any commission on business going over his road.

The newly elected chairman of the Western Passenger Association, J. R. Buchanan, has notified the managers that he will not accept the position unless they will guarantee him a term of at least three years. As they were not in a position to do this, they have called a meeting for next week to elect some one else. It is understood that another objection was that they proposed cutting down the salary from $10,000 to $7,500, which Mr. Buchanan would not agree to.

Some of the Western lines are becoming exceedingly restless over the way traffic is moving in the Southwest, and to Omaha and Colorado points. For instance, statistics on Denver business show that in May the percentage carried by the Atchison was 26, against 16 in January; by the Missouri Pacific, 13, against 7 in January; by the Union Pacific, 37, against 28 in January; while the percentage carried by the Burlington has fallen from 28 in January to 16 in May, and the Rock Island is still worse off, its percentage in May being only 6, against 19 in January. The last named road has called upon the Commissioners of the Western Traffic Association to equalize the business, so it can get a fair share, as provided in the agreement.

In the southwest (Chicago and the Missouri River) the total tonnage westbound from March 1 to May 24 was distributed as follows: Atchison, 17.4 per cent.; Alton, 14.8 per cent.; Burlington, 15.5 per cent.; St. Paul, 4.4 per cent.; Rock Island, 9.1 per cent.; Maple Leaf, 3 per cent.; Ft. Scott, 4.3 per cent., Missouri Pacific, 25.6 per cent.; Wabash, 5.9 per cent. Of 769 car loads of iron, wire and nails shipped from Chicago and east to southwestern Missouri River points from Dec. 1, 1891, to May 21, 1892, the Missouri Pacific carried 54 per cent. Of 161 carloads of agricultural implements, the Missouri Pacific secured 57 per cent. Of all Omaha business it secured 21 per cent. Of sugar shipped to Omaha in March and April it secured 70 per cent. Naturally the other lines are vigorously kicking and insinuating that the Gould lines must be manipulating rates in some manner. On the other hand, the Atchison got 98 per cent. of the total tonnage of sugar from Boston, Philadelphia and New York to this territory during March and April.

The Commissioners of the Western Traffic Association have rendered a decision authorizing a rate of one way fare to the second annual meeting of the National Mining Congress at Helena, Mont., July 12, via all routes through Denver and Ogden. The Trans-Missouri lines were unable to agree upon this, owing to the objection of one member who feared a cut in the tourist rate. Objection was subsequently withdrawn.

The Union Pacific and the Santa Fe will both meet the rate of $2 on ore and bullion from Colorado common points to the Missouri River made by the Rock Island, to go into effect to-morrow.

The meeting of the Trans-Missouri Association yesterday failed to elect a successor to Chairman Smith. After some discussion of the subject it was agreed to let matters stand with Secretary McFadden as custodian of the records until Sept. 15, unless in the meantime another meeting shall have been called and a chairman elected.

On June 14 the Pennsylvania announced a reduction to $7.50 for round trip tickets from Pittsburgh to Chicago for the Democratic National Convention, a cut of $3 from the rate previously announced. The agreed rate for the round trip to Chicago is $12. The reduction is to meet a Pittsburgh & Western rate. The latter line made a round trip rate of $15 to a certain club which is said to include the use of Pullman cars, four meals en route, two each way, and four days' hotel fare at Chicago.

Traffic Notes.

The Massachusetts Senate has rejected the bill regulating the arrangement of sleeping car berths, which was passed by the lower house of the legislature.

The Mobile & Ohio has forbidden station agents to sell tickets for dead bodies to any point beyond the line of their own road, or to make any arrangements for through transportation.

The Northern Central is taking out of Baltimore about 20 carloads of strawberries daily, mostly for Central New York and Pennsylvania. Up to the end of last week 266 cars had been shipped this season.

The different lines of sailing vessels between New York and Australia have competed so sharply for freight that the rates have been reduced to 8 cents a cu. ft., the common rate three years ago having been 24 cents a cu. ft.

A through sleeping car line has been established between Chicago and Memphis over the Illinois Central and the Newport News and Mississippi Valley, via Fulton. This is the first regular through car ever run between these points.

The Trunk Line Association has authorized an increase in the differential of the New York, Ontario & Western on westbound freight, an order having been issued making the rate (first class) from New York to Chicago 10 cents less than by the standard lines; the former differential was 8 cents.

Manager Leeds, of the California Traffic Association, has sent another memorial to the State Railroad Commissioners, comparing rates on the Southern Pacific from Sacramento to points in the Sacramento Valley with rates on the Northern Pacific from St. Paul westward. A large number of commodities is named. The average of the California figures is more than double that of the others.

The suit in the United States Court to dissolve the Trans-Missouri Freight Association has not been dropped, as was stated last week. Commissioner Walker has issued a statement to the effect that the case has simply been postponed until Aug. 1 on account of some misunderstanding of technical points by the lawyers. The trial in August will be before Judge Riner at Cheyenne, on account of the illness of Judge Foster.

The lines between St. Paul and Chicago having reduced the passenger rates to points in Eastern Canada on account of a reduction made by the Soo line, the latter on June 10 made a further reduction to the basis of $30 round trip between St. Paul and Montreal. Three days later the Chicago lines made a further reduction of $3, under which, if the lines east of Chicago demand their full proportion, the Northwestern lines must receive only about $6 for the round trip. The reports seem to indicate that round trip tickets are the only ones subject to the reduction.

On June 12 the Pennsylvania road will put on an additional westbound express train, to be called the Southwestern Express. It will leave New York at 8:30 p. m. and run through to St. Louis, reaching there at 7 o'clock on the morning of the second day. It is not clear whether the number of trains is to be increased throughout the whole distance, the time of the arrival of this train at St. Louis being the same as that of No. 9, which leaves New York at 6:30 p. m. The New York Central will put on the "Eastbound Empire State Express" on June 27. It will leave Buffalo at 1:15 p. m., and reach New York at 10:30, the time thus being 35 minutes longer than that of the westbound Empire State express.

Eastbound Freight Shipments.

Eastbound shipments of freight from Chicago last week by all roads amounted to 53,736 tons, against 49,006 tons for the preceding week, an increase of 4,730 tons, and against 43,389 tons for the corresponding week last year, an increase of 10,347 tons.

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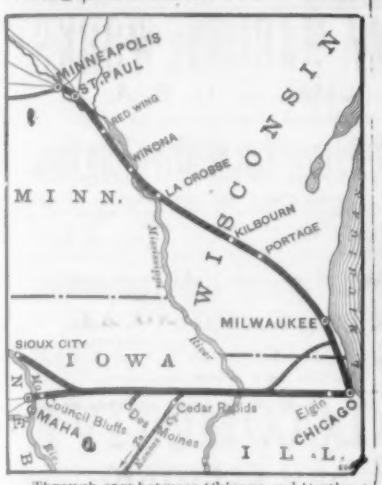

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